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ENGINEERING & MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

The Chino Enterprise—II

By T. A. Rickard

Mr. Rickard continues his historical account and tells of the organizing of the present Chino Copper Company

Is Aerial Transportation of Ore Practicable?

The author, an aeronautic consultant of experience, says it is and estimates the cost under given conditions

By Adrian Van Muffling

Conditions Safer in Siberia

An American mining man, just returned from the gold districts of the Far Eastern Republic, writes in Discussion this week, reporting a greatly improved state of affairs under the new Russian government

The Situation at the Mines

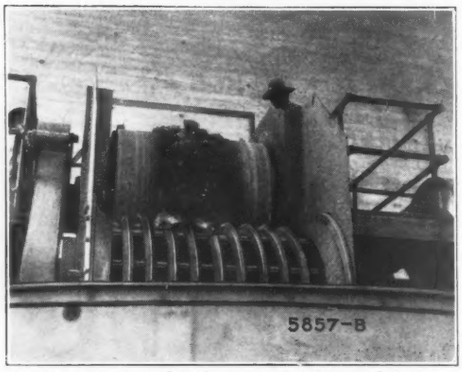
Operating conditions reviewed

Freight Rates on Ores and Concentrates

A tabulation of the rail and water charges between mine, smelter and market

Current Prices of Materials and Supplies

A guide for the purchasing agent and the warehouse man



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The Burch Grizzly is absolutely non-clogging, the ingenious arrangement of fixed and loose rings provides accurate spacing at the top while giving complete freedom of release for the fines.

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JOSIAH EDWARD SPURR, Editor

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The Future of Mining Engineering

STATISTICS are always interesting, and sometimes instructive. We were interested recently, for example, in learning that New York City spent fifty million dollars a year for household furniture, but more than twice that amount for tobacco. And when statistics are applied to our own industries they become still more readable. For example, in 1920 in the United States 41,600,000 persons were "gainfully employed": but of these less than 4 per cent (3.6 per cent) "planned the activities and directed the energies of the whole working force"—1,510,219. This executive group comprises "major officials, managers, superintendents, technical engineers, designers, draftsmen, inventors, architects, chemists, assayers, metallurgists, and auditors, together with one quarter of the foremen." Out of this administrative group of approximately 1,500,000, those engaged in the extraction of minerals numbered 43,558. This includes, of course, besides metals, the so-called "non-metallic minerals," coal, and petroleum.

The relationship of college graduates to the administrative group (1,500,000) is shown by the fact that there are 300,000 living male graduates of colleges and engineering schools; out of which the total number of engineering graduates is 70,000.

The above figures are taken from a report by the National Industrial Conference Board on "Engineering Education and American Industry." The report does not state the number of graduates in mining engineering out of the 70,000 living engineers, so we have been moved to compare the membership of the different chief engineering societies, to arrive at an approximation. The total membership of the American Institute of Mining and Metallurgical Engineers is 9,776; of the American Society of Civil Engineers 10,967; of the American Institute of Mechanical Engineers 17,737; of the American Institute of Electrical Engineers, 15,833. Thus, the Institute of Mining Engineers has 18 per cent of the whole membership of the four engineering societies, and this percentage, applied to the 70,000 figure above, would give about 12,600 living mining engineering graduates. It is evident, of course, that the members of the founder engineering societies are not all engineers, so that the estimate is an approximate one. In the A.I.M.E. the associate members and junior members alone constitute a large non-engineering group.

The report of the National Industrial Conference Board holds out hope for the future importance of the engineer in general. It shows a steady and regular increase in the proportion of the administrative group to the total number gainfully employed from 1.25 per cent in 1870 to 3.60 per cent in 1920 and, following the curve, shows that the proportion will be 3.80 per cent in 1930. Industry is plainly falling more and more under the guidance of executives, and is less and less run by loose methods. The conclusion is that there will be room in the industries for more graduates than the engineering schools are now turning out.

Although the above is true of engineering in general, there are certain peculiarities of the mining industries which make it necessary to consider them apart from the other industries into which engineering direction largely enters. Nevertheless, it must be true that the expansion of manufacturing and construction industries will entail a constantly increased demand for raw materials, and hence that somehow the output of mining must increase, and therefore the opportunity for the graduate in mining engineering. But far more than other engineers, the mining engineer must hold himself ready to slip from America to India or to South America, or to Africa, for his industry, more than any other, is international, and least dependent upon the fixed location of industrial plants and centers of population and manufacture.

Treasure vs. Mines

TRAVELERS in remote and little-known parts of the world often return with tales of gold and diamonds, undeveloped in the wildernesses they have penetrated, or the hinterland back of these wildernesses. They have seen ornaments of gold, necklaces with precious stones, images inlaid with precious metals; and they argue thereupon that a great harvest lies ready in that region for the magic of modern mining.

Yet the more experienced investigator knows that gold is, so to speak, no real indication of a gold mine: that a precious stone is no definite pre-runner of a precious-stone industry. Pizarro found an immense amount of gold, according to history, in the possession of the Inca kings in Peru: as Cortez did in the courts of the Mexican monarchs; yet neither Peru nor Mexico has been noted as a rich gold-mining country subsequently. In Macedonia the great Alexander had mines of gold—placer gold—which he inherited from his father, Philip of Macedonia; yet in the modern sense there are no gold mines there, the amount being so small that it cannot be won at a profit—only the unpaid and almost unfed slave labor of the Macedonian system was able to take out the precious metal.

Gold, again, is indestructible, and is hoarded; also it tends to segregate in the places where great wealth abides, as in the palaces of the old-time kings; so in the course of centuries, a great store of gold treasure may be collected together from occasional pockets in otherwise worthless veins, or from nuggets picked up out of the gravels now and then. But they do not indicate, we repeat, wealth to the miner. There are plenty of places we know where it would be easy to amass, out of the rocks and gravels, a dazzling treasure of gold; but in these inconsiderate times, when we must pay for men, machinery, and grub, it would be a far too expensive pastime to collect such a "king's ransom."

We read in the paper this morning that a man picked up a pebble the other day on a Long Island beach, and

it turned out to be a white diamond worth $3,000, yet this doesn't signify that a company should be formed to mine the beach, or the formations back of it. Diamonds have been found here and there throughout the glacial drift of northern and eastern United States; but the location of the bedrock concentrations, if any exist, is something at present beyond the power of industry and science. We picked up once in the cellar of a house a shilling of the time of George IV; but that did not indicate that we should dig in the cellar for treasure.

Engineering methods of appraisal are necessary to demonstrate a probable mine, even in the presence of the most glittering traditions, treasures, or "samples." To those whose imaginations are richly developed, this demand on the part of investors seems stupid and even culpably mean; but if investors wish to retain their capital in the long run, or even to have a fair gambling chance when they risk it, they must entrust the investigation and appraisal of lands and properties to engineering science, not to the romantic methods which characterize mining enterprises as presented in the moving pictures.

The Intellectual Deadline

TEACHERS are so inclined to stress the finality as well as the importance of education in school or college that no surprise will be occasioned by the recent utterance of a member of the faculty of the University of London, who, if reported correctly, announced in all seriousness that "The twenty-fourth birthday is the educational deadline in the life of the average man or woman of today. The young person who reaches this age unequipped," he continues, "is seldom able to make good the deficiency."

This conclusion is at variance with fact. Many if not most of the successful men of the day have been enthusiastic students since leaving school or college. In radical opposition to the new philosophy, one may state with conviction that canned education, which is the type obtained by the payment of a fee, can do little more to the ambitious than inculcate a sense of mental immaturity, and so add encouragement to the quest for that higher education acquired by contact with big men and big ideas.

The student as a rule is taught to be merely receptive. When he leaves the university equipped with a diploma, and evidence of having fulfilled the demands of the institution, he should realize that his education is just beginning; from then on he should be acquisitive, not merely receptive. Success will come to him in direct proportion to the amount and grade of acquisitiveness he develops. As he proceeds to learn what cannot be found in books he will be more and more inclined to discount the opinion of the London savant.

Mental decay is usually a concomitant of physical deterioration; and we are inclined to subscribe to the opinions of Mr. Edward B. Hughes, who contributes to *The Writer*, on the subject of classification according to age. "It is not right," he says, "to speak of a man of sixty as "aged." A man is young—or ought to be—until he is forty-five. A man from forty-five to sixty is middle-aged. A man from sixty to seventy is elderly. A man from seventy to eighty is advanced in years. A man from eighty to ninety is aged, and a man of ninety or more is venerable—sometimes."

Research in the Non-metallic Mineral Industries

FLINT ARROWHEADS of Indian manufacture, and crude weapons or implements of the stone age were the first products of the non-metallic mineral industries. From these primitive beginnings each advance in civilization has been accompanied by a broadening of non-metallic activities. The most rapid advance was made in structural materials, as used in the pyramids and obelisks of Egypt, and the Greek and Roman temples; but other substances, notably fuller's earth and clay, gradually came into use.

For the most part the non-metallics have led a commonplace existence in the realm of minerals. Throughout their long history few great inventions or discoveries relating to them have commanded public interest, and even in modern times no remarkable achievements have brought the non-metallics into prominence, with the possible exception of the processes of calcination of limestone and gypsum and the manufacture of hydraulic cement. Although the history of mining bears the names of many notable engineers and metallurgists, the non-metallic field has contributed few. Metallic luster has ever enticed the adventurous searcher in the realm of mineral products; the drab and earthy character of the abundant and ever-present non-metallics has occasioned only the familiarity that breeds contempt.

This state of affairs is gradually changing. Millions of dollars are spent annually on non-metallic products; almost innumerable applications to every phase of human activity have been developed; and there has come an increasing respect and a keen interest that invites research and invention. Cement, lime, slate, gypsum, and even the commonplace crushed-stone industry have each a research program.

An evidence of the recognition now being afforded the non-metals is the recent establishment by the government of an experiment station under the direction of the Federal Bureau of Mines, to be devoted exclusively to problems in non-metallics. Centered at Rutgers College, New Brunswick, N. J., in the heart of the great non-metallic producing industries of the eastern United States, and within easy reach of the consuming centers, the new station occupies a strategic position that should enable it to render great service.

The new station is unique in the history of research, for apparently no effort has heretofore been made to establish a government experiment station devoted solely to non-metallic minerals exclusive of fuels, oils, and ceramics. Thus in a way the station becomes a research pioneer, and just as the field is new and strange, so are the methods of operation. To most scientific men the term "experiment station research" conveys the impression of laboratory investigation as a primary and dominating function. It appears, however, that among non-metallic minerals many of the more pressing problems are not of a type that can be solved in a laboratory, but must be worked out under actual operating conditions. For such problems the mine and quarry become the laboratory where specialists must observe, study, and develop new processes in close co-operation with the producers. Such field studies will center in the new station, and it is probable that they will constitute an important part of its early activities.

Underground Training for Young Engineers

ONE OF the practical difficulties in the education of mining engineers is the provision for contact with actual mining operations. Many of the mining schools require undergraduates to spend the summer interims, wholly or in part, in work in mines. Others, in addition to this requirement, attempt to operate an underground excavation in the near vicinity of the school and demonstrate therein timbering and rock breaking. Excursions to mining districts are also resorted to. There is evident a sincere effort to acquaint the mining student with a real substratum upon which to visualize his college work.

Mining companies have co-operated to a greater or less extent with college authorities in opening opportunities for students to acquire a knowledge of practical operations. Recently the United Verde Copper Co. has offered to take a limited number of mining graduates and students on the basis of a two-year period to be devoted to practical mining. The company plans to give the student, while working, an intimate knowledge of practical mining details. The mine work will be supplemented by semi-monthly lectures on pertinent subjects. The offer is restricted to those who have the necessary physical ability. This is in our opinion a better post-graduate course than can be offered by the college. We venture to say that a student who has done his part thoroughly in a four-year course and who takes full advantage of the opportunity afforded by the United Verde plan or similar plans by other mining companies will be more useful in the mining industry than a five- or six-year graduate who has only limited acquaintance with going practice.

The United Verde plan is sound. Other large companies can with benefit to themselves and the industry initiate similar plans.

Production and Storage of Petroleum in California

THE CONSERVATION of a considerable proportion of the reserves of the influential oil companies operating in California, and the purchase by them of the output of the smaller fry at rock-bottom prices, indicates a shrewd anticipation of the problem of diminishing supply and increasing demand that must inevitably arise in the not-too-distant future. Albeit, the large companies are incurring losses that arise as a consequence of drainage in the vicinity of their wells, but recognition and estimation of this is not likely to alter their present policy. With at least one product selling at below the cost of production, the husbanding of reserves is sound logic. The tremendous output of the Californian oil fields has demanded that heroic measures be taken to provide storage facilities. Steel tanks, even of giant dimensions, are being realized to be of restricted capacity. An immense reservoir is now being constructed by the Standard Oil Company of California at its tank farm at El Segundo, near Los Angeles, which will have a capacity of over 3,000,000 bbl. Excavation is in progress and reinforced cement will be used for lining and roofing purposes. The refinery and farm covers about 1,200 acres, the former having a capacity of 90,000 bbl. per day. Storage facilities comprise over 300 tanks, with a total capacity of over 5,000,000 bbl.; and 12 reservoirs of a total capacity of over 15,000,000 bbl., the latter occupying over 100 acres. A network of piping and hundreds of pumps permit the loading of 133 tank cars per eight hours. In addition, unusually complete facilities are provided for the transferrence of oil aboard ship. Provision has been made for supplying coastal vessels at the rate of 4,500 bbl. per hour, and foreign tankers and off-shore boats at the rate of 38,000 bbl. per hour.

These figures are impressive, as indicating the tremendous activity in the Californian oil industry at the present time. Whether our national profligacy in the use of oil will be regretted, whether new products, the result of research and technical development, will take the place of petroleum when the wells are dry—these questions are for conjecture only.

Good Money After Bad

THE ABOVE CAPTION is placed above one of the answers to inquiries in the investment section of the *New York Tribune*. Here is the question:

"I would be very thankful to you if you could give me advice on this matter. I have 2,000 shares of a stock called The Butte-Jardine Metals Mines which were bought in 1917 at 35c. a share. This stock was non-assessable until a few months ago, when they decided to make it assessable. From their annual reports it seems the mine is not a prospect only but a producing mine, although I have never had any benefit from it. They say on account of the low value of silver they are obliged now to ask 5 per cent a share of each stockholder; that would mean $100 for me to pay in order to keep the shares. The assessment must be paid on or before Nov. 10, and if not paid at that time, the stock will be sold at auction with the $100 deduced. As I am a woman without the least knowledge of such things and very low funds at present (my husband died recently), I cannot afford to lose $100, supposing the stocks were of no value. I found these shares amongst my husband's papers, and don't know anything about that mine. Have you ever heard about this? They seem to own what is called the Champion mines. As I have no one to tell me what to do in this matter, I shall either send the $100 or drop the stock entirely just as you advise me. Thanking you for anything you will do for me.—Mrs. A. S."

And here the answer:

"In June, 1922, at auction, 28,000 shares of Butte-Jardine sold at $50 for the lot, or at the rate of less than one-fifth of a cent a share. Your stock shows a loss of $700 at the present time, and there is no earthly reason why you should add to this loss by contributing $100 more. Don't do it! Your letter appears in this column because we know that many holders of worthless mining stocks are being similarly approached, and trust that the opinion here stated will assist them in making a right decision."

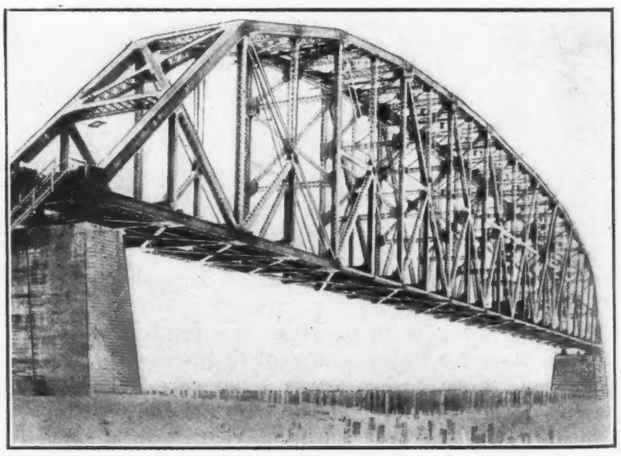
And what is the moral? Does not every honest miner resent the general and just contempt with which "mining stocks" are treated by every financial writer? Is he not willing, as a hard working, conscientious representative of a sound, basic industry, to help to eliminate the rotten misrepresentation of a majority of mining stocks offered to the public? We hope to see the day when the mining industry will clean house. The American Mining Congress could help in this if it will. But this organization can never attain the odor of standing and principle so long as it has no method of discrimination among its members; so long as it lets the unscrupulous and impudent throng its meetings and pack its committees, side by side with the upright and the conservative, and as long as it cynically stands for the policy of "hands off" with regard to the most flagrant assaults on public confidence and purse, by the cheap promoter parasites of the mining industry.

At Turnagain Arm, on the Anchorage division of the Alaska Railroad, showing not only construction difficulties which had to be overcome but the splendid condition of the finished roadbed

The Alaska Railroad

WHEN the Tanana River bridge was completed this year, nine years of work in building the Alaska Railroad from the seacoast to the interior of Alaska came to an end. Trains make the 470-mile trip from Seward to Fairbanks in two days, running only in the daytime. The route finally selected begins at Seward, passes around Turnagain Arm, across the Matanuska Valley, up the Susitna Valley, over Broad Pass, and thence along the Nenana River and the drainage system of the Tanana River to Fairbanks. Thus the road touches and passes through two of the three well-known coal fields of Alaska; taps the only extensive agricultural lands; is tributary to several mining districts, none of which is yet fully developed; and borders the Mount McKinley National Park. The railroad was built in a wilderness where every facility had to be developed and carried along with the actual construction work. All equipment had to be shipped from Seattle, 1,500 to 2,000 miles away. For all this, the cost of construction, including the rolling stock, was $85,000 per mile. Nenana is the transfer point for traffic down the Tanana and Yukon rivers. A river-boat service has been initiated by the railroad. Two boats formerly owned by the Quartermaster Corps of the Army were turned over to the Interior Department and now run on a regular schedule down the two rivers as far as Holy Cross. This government-built railroad will no doubt prove the largest single factor in the development of the territory. Before it was built the interior could be reached only by river boat in summer and by dog sled in winter. The development of Alaska in the future will be built upon the experiences of the past. Though bonanza mining deposits doubtless remain to be discovered, the territory will never again be entirely a bonanza country. The trend now is toward the development of permanent industries, mostly mining, but development built on long-lived orebodies and insuring employment for workers over a long period.

Steam shovel at work on railroad construction a short distance outside of Anchorage



The second longest single-span railroad bridge in the world, placed across the Tanana River at Nenana

Transporting Ore by Airplane

What Are the Factors Involved? What Will It Cost, and How Big Must the Investment Be?

By Adrian Van Muffling
Aeronautic Consultant, 17 East 42d St., New York City

RECENTLY an airplane succeeded in making the first transcontinental non-stop flight across the country, leaving New York at 1.30 p.m. and arriving at San Diego, Calif., at 3 p.m. on the following day. When it left New York it carried a total weight, including the machine itself, of 10,850 lb. Nothing epitomizes more fully the wonderful progress that has been made in aircraft development during the last few years.

That the possibilities inherent in this method of transportation will be made extensive use of in the future none can doubt, and that this country will some day be covered with a net of air lines carrying goods and passengers in a minimum of time—as is now being done in Europe—is a foregone conclusion. Neither is there a doubt that the American business man will in time overcome his present timidity regarding air transportation and that after a safe and reliable system has once been established he will avail himself thereof to the fullest extent. Air transportation, however, can progress only by easy stages and by beginning in such districts where its inherent superiority can display itself to the best advantage; and it is in connection with mining operations that that superiority can immediately be utilized with positive assurance of success.

The problem of substituting airplanes for present means of transportation in carrying ore from outlying mines situated far from a railroad has frequently been outlined in the *Journal-Press*. Two years ago Eugene Bisbee gave an admirable discussion on this subject, and articles have appeared at various times anent the value of aircraft in exploring, mapping, surveying, and prospecting. All these discussions have treated the problem from a purely academic point of view, and no attempt has been made, to my knowledge, to analyze the requirements for carrying ore via the air.

"This is all very well," the experienced mining engineer or superintendent is apt to say; "I know that airplanes can fly; I know that they are safe and reliable; I also know that they can carry considerable weight; but what I want to know is how much will it cost per ton to carry my stuff to the nearest railroad, and what will be required to do it reliably and efficiently." In the following pages an attempt will be made, with the aid of examples, to analyze the situation and to answer these questions for the practical mine-plant executive.

It should be understood at the outset that the nature of airplane transportation, especially in outlying districts, is of such a highly specialized character that it is impossible to formulate any rule or even establish a set of data that will apply to any number of given places. Every single problem of this nature must be studied and its possibilities determined from every angle, as a separate undertaking. In making an analysis of any given locality, and in formulating an estimate of expenses, there are, however, certain factors which are inherent in the very nature of airway transportation, and which are well known to those who have made a study of this subject. A list of these factors and a discussion of the conditions affecting them will be found later in this article.

THOUGH it is quite out of the question to run a successful passenger air line between cities with obsolete ships or military machines rebuilt into commercial carriers, it is entirely within the range of possibility to carry ore in such equipment with perfect success. An airplane designed to carry ore or concentrates must be efficient from an engineering point of view, but requires neither great speed nor refinement in the luxury of its appointments. Even a mediocre technical efficiency may be counterbalanced by a very low first cost, with consequent moderate depreciation charges and economical upkeep

Figures that have been obtained in previous analyses of aircraft transportation in this country cause one to feel hopeful about the financial possibilities in this particular application. I have had occasion to analyze and prepare advance financial estimates for prospective airlines in many parts of the United States, and as these lines invariably contemplate the carrying of passengers and freight on a regular scheduled basis, many factors had to be taken into consideration that need not be considered in a discussion of mining transportation. Nevertheless, it was found that the total average expense of running commercial airplanes of the most modern type amounts to a figure between 40 and 60c. per ton-mile, the exact amount depending upon the type of ship, the distance between terminals, the number of intermediate fields, frequency of trips and other minor considerations. These estimates take everything into account, including all items that could be termed fixed charges, such as: (1) ship insurance; (2) liability insurance; (3) rental of fields; (4) upkeep of fields; (5) hangars, both terminal and intermediate; (6) interest on investment, including the erection of terminals and station buildings; (7) office expenses; (8) automobile equipment to carry passengers to and from the fields; (9) advertising and publicity, and several others. The majority of the above-named items do not require consideration in the case of a line which is intended to carry ore and supplies to and from a mining district. They are also predicated upon the use of the most mod-

ern and hence the most expensive types of flying equipment.

It is evident, however, that an airplane designed to carry ore or concentrates must be efficient from an engineering point of view (that is, the ratio weight: cost must be high), but requires neither great speed nor refinement in the luxury of its appointments. Though it is quite out of the question to run a successful passenger air line between cities with obsolete ships or military machines rebuilt into commercial carriers, it is entirely within the range of possibility to carry ore in such equipment with perfect success. And even a mediocre technical efficiency may be counterbalanced by a very low first cost, with consequent moderate depreciation charges.

The comparatively low rate per ton-mile above mentioned can therefore probably be reduced materially where all the charges inherent in the operation of an air line as a common carrier do not apply.

Fig. 1. Fokker combined monoplane and biplane (Dutch)

In this type the lower wing can be removed in fifteen minutes, and the machine can thus be turned into a cantilever monoplane. As shown in the photograph it will carry 2,650 lb. at 112 miles per hour. Without the lower wing it can take only 2,000 lb., but the speed is thereby increased to 118 miles per hour. The type is very popular on many European air lines and is used almost exclusively in the network of lines which is being established in Russia.

While to the layman the problem of carrying ore may appear to be simply a question of having an airplane and starting to put it in operation, it should be understood that the question is, in fact, not so simple a matter. Before undertaking the actual operation, considerable "groundwork" has to be done to insure successful and economical results. The factors that have to be taken into consideration before even a financial estimate can be prepared are the following:

1. Territory over which it is intended to fly, and character of route.
2. Landing fields.
3. Character of ore.
4. Flying equipment.
5. Depreciation and insurance.
6. Organization and personnel required.

Character of Territory and Route Important

The character of territory and route is more important than appears on first consideration. First of all there is the question of altitude. Gasoline engines do not develop nearly the same power at high altitudes as they do at sea level. Secondly, wings constructed to carry a certain load at low altitude (meaning not higher than 3,000 ft.) will not perform the same work if brought into a more rarefied atmosphere. Both factors affect the "climbing ability" of the plane, and the load that it is capable not merely of sustaining but of *lifting* into the air. The use of engine superchargers, which are essentially exhaust-driven compressors, to supply carburetors with air at normal sea-level pressure, would obviate the first difficulty. The second might involve structural changes in the machine, such as increasing the area of the wings to compensate for the loss of sustaining power, or substituting wings especially designed for high-altitude work. Special propellers would have to be fitted in any case.

Whether the country is flat or mountainous will not make much difference except for the effects of air currents in the latter case. A study of local conditions, preferably by a few test flights, will quickly reveal just what are the most "flyable" routes along the line, and if sufficient altitude can be obtained to clear obstructions soon after leaving, one need not worry much about air currents with a modern, well-designed ship.

In the majority of cases the route will lay along some valley tributary to the main river of the district along which the railroad usually runs, and level spaces that can be easily adapted for the purpose of landing fields at slight expense are likely to be found in such locality. It may, however, be necessary to cross mountain ranges or high plateaus located above timber line, where fields will not be so easily established.

A decided advantage is found in the likelihood that the carrying of ore will generally take place from a high altitude to a lower one, in many localities involving a difference in level of several thousand feet over a course of a few miles. Gravity can be utilized with an airplane as well as with any other method of transportation, and a high difference in levels may enable one to glide down with a load the greater part of the distance, with the

engine stopped or running at very low speed. How much this means in preserving the life of motors anyone who has had experience with airplanes can appreciate. It is true that the return trip must then be made with a constant upward pull, but with a machine which is either empty or carries but a small fraction of its maximum load capacity in passengers or supplies.

Landing Fields Must Be Carefully Chosen

The decrease in sustaining capacity at high altitudes requires a greater speed before the airplane is capable of lifting itself and its load. In consequence a longer run on the ground is necessary than at lower altitudes, and the obtaining of level ground of sufficient size may be a serious problem. In some sections of the country, as in the wastes of the southwestern states, it may be an easy matter to clear suitable ground at slight expense; in other places it may require the clearing of timber land or leveling operations on a considerable scale. A field should be at least 2,000 ft. long and not less than 300 ft. wide, but, what is just as important, is the clearness of the approach, as an airplane rises at a very small angle and may require half a mile or more to gain sufficient altitude to clear standing timber. Along the bottoms of major valleys in which alluvial ground is usually present such fields ought not to be difficult to find. In the higher reaches, however, where the mines are more likely to be located, the selection of a field of sufficient proportions may present considerable difficulty. In this connection it should be noted that the field should be *level*, or at best possess only slight declivity toward the direction of the prevailing wind. Contrary to common belief, a downhill run prior to its valley and gather sufficient flying speed thereby. This should not be done except in an extreme emergency, and only with loads of which the value might warrant a certain additional risk. For landing, some such device as is used on board airplane-carrying ships to permit quick landings and short stops might be adopted to advantage.

It may be asserted *a priori* that—as with all forms of transportation—the character and relative value of the load is the most important factor in determining whether its transportation is economically warranted or not. One could hardly expect iron ore or low-grade copper ore to be carried profitably by airplane over even short distances. Weight is more of a factor than bulk, and in most cases the maximum weight of ore which an airplane can carry will take only a small percentage of the volumetric capacity of the machine. A machine large enough to carry one ton of ore, occupying about 8 to 10 cu.ft., will actually have a hold capable of containing about 180 cu.ft. of lighter merchandise.

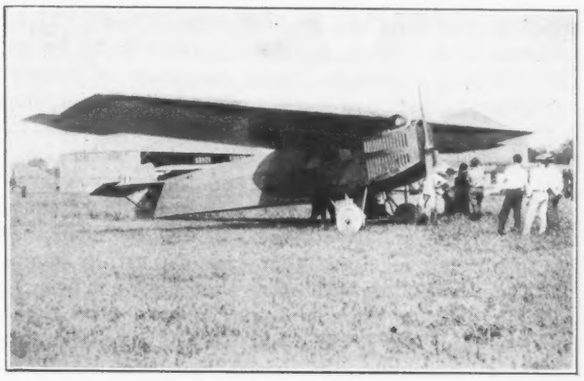


Fig. 2. Fokker F-3 monoplane

One of the most economical made; it carries six passengers, or 1,000 lb., with a motor nominally rated at 165 hp. It is extensively used on cross-Channel routes. The simplicity of cantilever wing construction is shown.

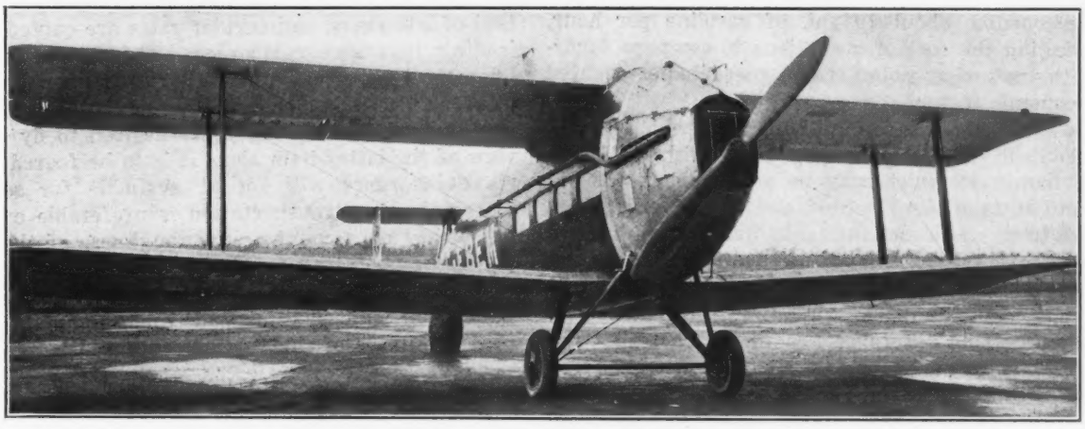


Fig. 3. Vickers (British) commercial plane

This machine, which carries 1,655 lb. of useful load and 520 lb. of gasoline, is the smallest of the large commercial machines now in use. Its span is only 49 ft. and its total length measures 38 ft. It is capable of flying 108 miles per hour maximum.

taking the air is not an asset for an airplane, due to the fact that an upward inclination of the wings is necessary to carry the machine into the air to the best advantage and at the lowest speed. To select a field which has a marked slope would be the worst possible choice.

On the other hand, there might be cases in which sufficient space for taking off could be found on a plateau, falling off sharply over the edge of a cliff. In this contingency there might be no harm in letting the machine be carried over the edge of the cliff before it actually left the ground, and allow it to drop into the

High-grade ores could be carried in paying quantities, and in some cases concentrates. Attempts have been made to carry ores across some of the deep arroyos of Peru by means of aircraft. In view of the altitude-

which exceeds 15,000 ft., it seems hardly likely that paying loads can be carried without using specially designed machines and supercharged motors. As before stated, each individual case must be figured out separately, and with due consideration of the pay-content of the ore and the local conditions.

Many Types of Commercial Machines Available

The selection of flying equipment is a question of expediency and suitability to the job in hand. If it be assumed that "commercial" equipment is to be used, (by which is meant no Army machines or converted war planes), there are many types which can be bought in the open market that will carry loads sufficiently great and at a low enough cost to make ore transportation feasible. At present all of these types are of foreign manufacture, but there is small doubt that in time American manufacturers will find sufficient incentive to produce machines that can successfully compete with them, although heretofore they have not been able to do so. As an example I may mention the type of machine which the government uses on its mail routes. This is of British design, which has been reconverted for carrying mail, and it has a capacity of 400 lb., to carry which it requires a 400-hp. motor. Some recent experiments have shown that changes in the design of the wings may raise its capacity to 800 lb., which is sufficient for mail-carrying purposes under government operation, where the taxpayers pay the bill, but which would yet be quite insufficient to keep a commercial undertaking from bankruptcy. On the other hand the machine shown in Fig. 2, a Fokker F-3, in which I traveled extensively over the Eastern States two years ago, will carry 1,000 lb. pay load plus 600 lb. of fuel with a motor of only 165 hp. (European rating) and actually consume about 10 gal. of gasoline per hour, thus bringing the cost of operations to compare favorably with that of a motor truck, speed being counted as an economic factor.

Fig. 1 shows another foreign-built type, which carries up to 2,650 lb. at 112 miles per hour, with a 400-hp. Liberty motor, to which may be added about 400 lb., which might take the place of gasoline if only short trips are to be made and the tanks are not required to be full. Here is, then, a machine that will carry about a ton and a half with the same expenditure for fuel that a converted war machine requires to carry 400 lb. The secret of this difference lies in the fact that the commercial machine has purposely been designed for economy in operation and carrying capacity, whereas the other was chiefly for purposes connected with warfare.

It might be possible to use converted machines in exceptional cases where the value of the stuff to be carried is very high in proportion to its weight. In such operation, the low initial cost of the older type of machine would tend to counterbalance its higher running expense. This again is a matter that can be determined only by a thorough study of local conditions affecting costs. Bullion, for example, might easily be carried at a profit over long distances in very inefficient machines, but cheap to purchase and hence burdened with a low depreciation charge.

In figuring depreciation it has been customary to assume an arbitrary value for the life of the machine. This value has been based not so much on previous experience but rather on obsolescence, it being taken for granted that after a certain period better types will be evolved to warrant scrapping of older equipment. In freight, and even more so in ore-carrying, lack of refinement is not so much of a factor as in passenger transportation. As a matter of fact, airplanes have not existed long enough to enable us accurately to gage their maximum life, provided, of course, that they are not wrecked. On some European lines machines have been in constant service for three years, and as long as they are taken care of and kept in proper flying condition there is no reason why they should not last that long again. It is the shocks of landing which cause the greatest depreciation; while the machine is in the air flying, the wear and tear is nil. For a modern ship 5,000 hours of actual flying time is not too high an assumption for a basis of calculation.

The depreciation of motors, however, is much higher in proportion. For the best and most reliable types 3,000 hours appears to be the maximum figure, at least under conditions such as have prevailed in commercial flying today. But even under these conditions it is likely that partial rebuilding, regrinding of cylinders, replacement of bearings—in short, all the maintenance which any motor truck receives as a matter of course—would lengthen the life of the motor materially over the above-named figure. As a matter of fact, airplane motors have all too frequently been regarded as in the class of watch mechanisms, which are kept running until they are "all done for," and it is only within the latter years that a systematic attempt at lengthening their lives by proper maintenance has been attempted. Army and Navy experience in this respect is largely worthless, it being the practice in those branches of the government service to replace defective motors by new ones rather than attempt extensive repairs, at least until recently.

Airplane insurance has become fairly well standardized of late years, and regular rates are quoted by many leading insurance companies. These rates are based upon the type of machine rather than upon its age, the pilot's experience, the condition of landing fields, and the kind of country that it is desired to fly over. In view of the latter item alone it is to be feared that airplane insurance will not be available for some time where airplane transportation is preferable over existing means on account of the roughness of the ground.

Anyone operating an ore-carrying route will have to carry his own insurance fund for some time to come, the rate of which will depend chiefly upon the financial responsibilities of the parties concerned.

A Small Organization Needed for Flying

A mining company which undertakes to transport its ores via air does not, fortunately, require a large organization for that purpose. The first requisite is competent pilots, by which is meant not merely men with a good record in war equipment but rather having had considerable experience in commercial flying, or at least cross-country flying under conditions approaching those to be expected in commercial work. Next in importance is a set of mechanics who know their business. Although men who combine the knowledge of a good mechanic and a good pilot are occasionally found, it is better to keep the two functions separate. It has been my experience that a pilot is apt to be too temperamental to be a good mechanic, and often lacks that patience in the adjustment of small things which characterizes the first-class repair man. A pilot who does his own maintenance has a tendency to divide his responsibilities—that is, to trust to good piloting to

carry him through some dangerous moments which may have been caused by his carelessness as a mechanic.

The number of pilots and mechanics required is, of course, dependent upon the number of machines in service, only one of which, or at the most two, are likely to be in the air at the same time. The type of machine is also a factor as regards the force of mechanics, and that is a point which should be carefully considered when buying equipment. Old-time biplanes which carry a veritable network of wires that have to be kept in proper condition require far more attention than modern machines of the cantilever type, such as is illustrated in Figs. 1 and 2. The maintenance required by the ship itself is small in such cases, the wing being fastened in such a manner that, once set, it cannot possibly get out of its proper position.

The principal item of maintenance being the conditioning of power plants, high competency in overhauling motors is essential, and the men detailed to this work do not necessarily require any knowledge of airplanes.

To sum up, I believe that to maintain an ore-carrying service involving not more than five hours' flying a day over short distances with three machines and two spare motors will require the following personnel:

One pilot.
One substitute pilot (who may be one of the mechanics).
Two motor mechanics.
One plane mechanic.
One helper (who may perform other duties).

A Flying Superintendent Necessary

Ore transportation by airplane should be under a superintendent of air transportation, responsible to the management of the company, and whose judgment should be absolutely final in all matters relating to flying, equipment, loads carried, meteorological conditions, and so forth. Although the temptation might be great to combine his functions with those of a pilot, temperament (which, though often scoffed at, is a real problem in all flying operations) is apt to become a disturbing influence, with harmful results.

It is, of course, quite evident that the mechanics will always be available for other duties and need not necessarily confine themselves exclusively to the upkeep of the flying equipment. For long periods at a stretch a daily inspection and current or "routine adjustment" is all that is necessary to keep the ships in good flying condition. The rest of the time it is important that the men be kept busy, by taking care of the other machinery about the plant or loading and unloading the ships. Anyone who has had experience around a flying field knows the bane of long hours of enforced idleness on the force of mechanics when there is literally nothing for them to do.

In preparing an estimate of cost it is therefore difficult to apportion the proper amount of mechanics' salary to the item of airplane transportation. In the following analysis I have charged two-thirds of their salaries to that purpose, assuming that that portion of their total time is actually devoted to the flying equipment.

The cost analysis of a hypothetical ore-transportation line on a ton-mile basis rests upon ship performance and maintenance *only*. Not being a mining man, I cannot attempt to undertake comparisons with present costs of transportation over difficult territory, which necessarily vary in each individual locality, and are beyond computation except on the spot. Any reader who is interested in the subject from a practical point of view can supply the necessary data from his own experience. There are many good mines or prospects which are now not being worked, on account of their inaccessibility, though the actual distance to the nearest railroad may be but a few miles, and where the establishment of a railroad, tramway, or automobile road entails the expenditure of an excessive amount. In such circumstances the airplane provides a means of immediate exploitation at a far lower cost, and, moreover, one which is not permanent, but which can be removed to another location if necessity or policy requires.

In considering costs, it should be borne in mind that the ordinary rule of airplane transportation, namely, that long hauls are the most economical, does not apply. In "ordinary transportation," by which is meant the carrying of goods and passengers, it is necessary to compete with railroad transportation, and the prime factor to strive for is *greater speed*, which is advantageous over long distances only. On the other hand, in transporting ore, economy becames a matter of carrying the largest amount of stuff with the minimum equipment, which resolves itself in making the greatest number of trips per day over a short distance. Valuable

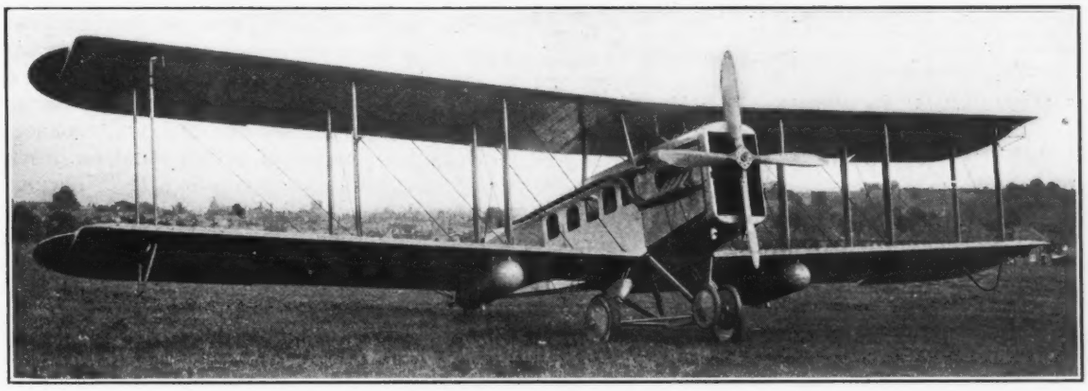


Fig. 4. Westland five-passenger limousine (British)

Carries 1,200 lb. useful weight. Has 450 hp. motor. Note location of fuel tanks under the wings far removed from any possible source of fire.

cargoes, such as bullion, may warrant hauls of one hundred miles or more—which can hardly be economically feasible for the majority of untreated ores.

In the following example, it is assumed that the distance to be covered between the mine and the nearest railroad is 20 miles. This requires a round-trip flight of 40 miles per unit load. Assuming a ten-minute period as sufficient time to load and unload the ship, which is easily feasible if the load has been previously divided into sacks of about 100 lb. each, and a sufficient number of laborers to be available, a round trip can be made in one hour. With two ships in service working eight hours a day, but actually flying only five and one-half hours, sixteen unit loads can be transported daily.

Ships of the cantilever monoplane type with 200-hp. motors will carry a load (if a full load of gasoline is not used) of 1,200 lb. This gives:

16 unit loads at 1,200 lb. each, 9.6 short tons per day.
16 trips at 40 miles each, 640 miles per day.
Fuel consumption, 11 hours at 12 gal. per hour, 131 gal. per day.

Oil Consumption

11 hours at 1¼ gal. per hour, 14 gal. per day.

Equipment

3 ships (2 in service, 1 reserve) at $10,000 each	$30,000
2 spare motors at $2,000 each	4,000
Extras, supplies	1,000
Total	**$35,000**

Fuel and Oil

131 gal. at 16c. per gallon	$21.00
14 gal. of oil at 50c. per gallon	7.00
Total	$28.00

Salaries

Pilot at $75 per week, per day	$12.50
1 mechanic at two-thirds of $60 per week, per day	6.65
1 mechanic at two-thirds of $50 per week	5.50
1 helper at two-thirds of $36 per week, per day	4.00
Total, daily	$28.65

Depreciation

Total life. 3 ships at 5,000 hours—15,000 hours at $24,000. Per day	$18.00
5 motors at 3,000 hours—15,000 hours at $10,000. Per day	7.30
Total, daily	$25.30

Hangars and Field

Assuming $10,000 to have been spent in improvements at 5 per cent gives $500 per year. Per day	$1.40

Total

Interest on investment $3,500 at 5 per cent, per day	$4.75
Fuel and oil	28.00
Salaries	28.65
Depreciation	25.30
Hangars and fields	1.40
Total, daily	$88.10

Thus 9.6 tons can be carried on an expenditure of $88.10 daily, which is equivalent to $10.90 or $11 a ton for the whole trip, or $0.55 per ton-mile.

The above example presents a fair approximation of the method utilized in making such estimates, which is based on the assumption that the mine-operating company does its own transportation. In districts where mines difficult of access are plentiful within reasonable radius from a railroad, a pooling of transportation facilities might take place among all parties interested, whereby the ton-mile cost to each would be considerably curtailed. In such circumstances it would probably be preferable to have each operator contract with an independent airplane transportation company serving the whole district on a ton-mile or flat trip-rate basis. Such a company would be able to take better care of its equipment and to curtail expenses by having a central base, where proper storage and maintenance facilities for a larger number of planes could be provided, than would the individual operator. It is obvious that an increase in service is not followed by a proportionate increase in expenditure.

Undoubtedly there are many districts in this country which are at present necessarily unproductive for lack of suitable facilities to bring their product on the market and where the conditions of intervening territory are such as to make airplane transportation the most suitable means to exploit their potential usefulness.

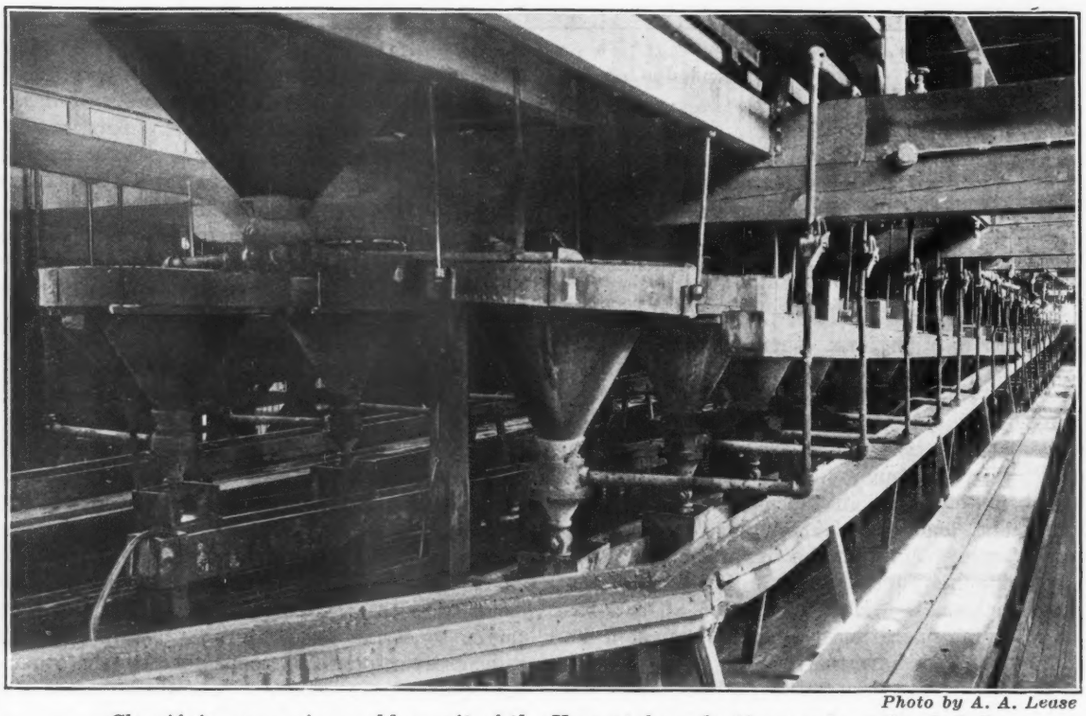
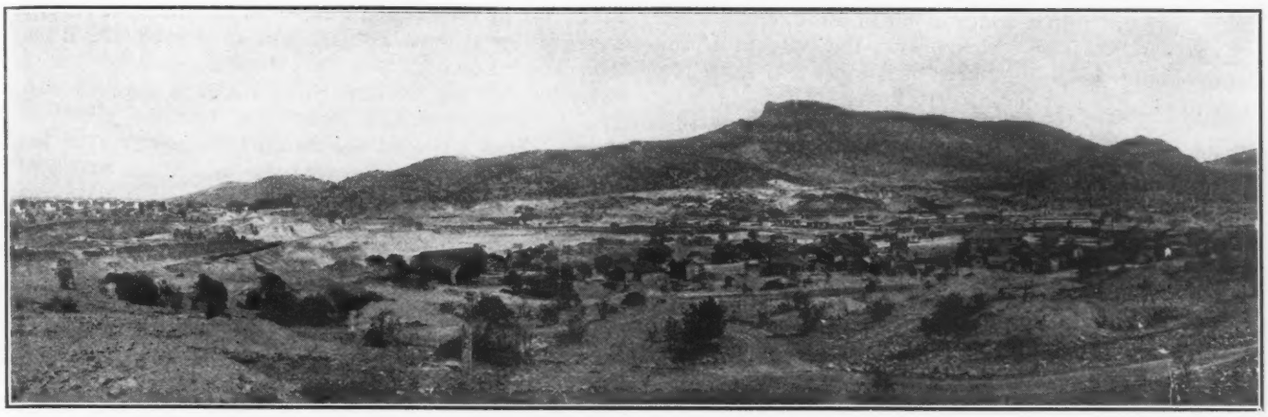


Photo by A. A. Lease

Classifying cones in an older unit of the Homestake reduction works at Lead, S. D.

They separate the slimes from sands, each of which has its distinct cyanide treatment subsequently.



Santa Rita in 1912

The Chino Enterprise—II

Later History and Formation of Present Company

By T. A. Rickard

IN 1897, as I have stated, the Hearst syndicate acquired the Santa Rita mines under lease and bond for two years from J. Parker Whitney. Benjamin B. Thayer was placed in charge as manager. At the end of the two years the property passed into the hands of a group identified with the Anaconda Copper Co.; and, of the purchase price to Whitney, the sum of $200,000 was paid to the representatives of the Hearst estate at Silver City for the release of their contracts. Mr. Thayer continued as manager. The new owners were H. H. Rogers, W. D. Rockefeller, Thomas W. Lawson, Albert C. Burrage, one of the Lewisohn brothers, J. Parker Whitney, and Marcus Daly. The corporation organized to exploit the mine was named the Santa Rita Mining Co. Most of the work under this ownership was done by lessees, but the company also mined on its own account and operated a 100-ton mill on the joint production. The mill was built in 1897, and Horace Moses was put in charge, under Mr. Thayer. The royalty paid by the lessees was high, for they received only $1 per unit; for example, $15 per ton on 15 per cent ore. "The store was a picnic", says an old-timer. It was an important source of profit because it was placed in the efficient hands of L. H. Bartlett, who is still there. Most of the miners were Mexicans, with a few whites, chiefly Cornish.

Early in 1902 Mr. Thayer opened up a nice body of high-grade sulphide ore in the Air Shaft ground, but the period of prosperity came to an abrupt end when the ore in the eruptive rock was followed to the limestone, in which it died out. The ore was a lenticular mass. That experience, says local gossip, caused the management to think that the mine had seen its best days and made them willing to sell the property, which, however, continued to be self-supporting, thanks largely to the store. Nobody foresaw the possibilities of the mine. It contained high-grade streaks that sweetened the output, but it was essentially a low-grade mine, as that phrase was understood twenty years ago.

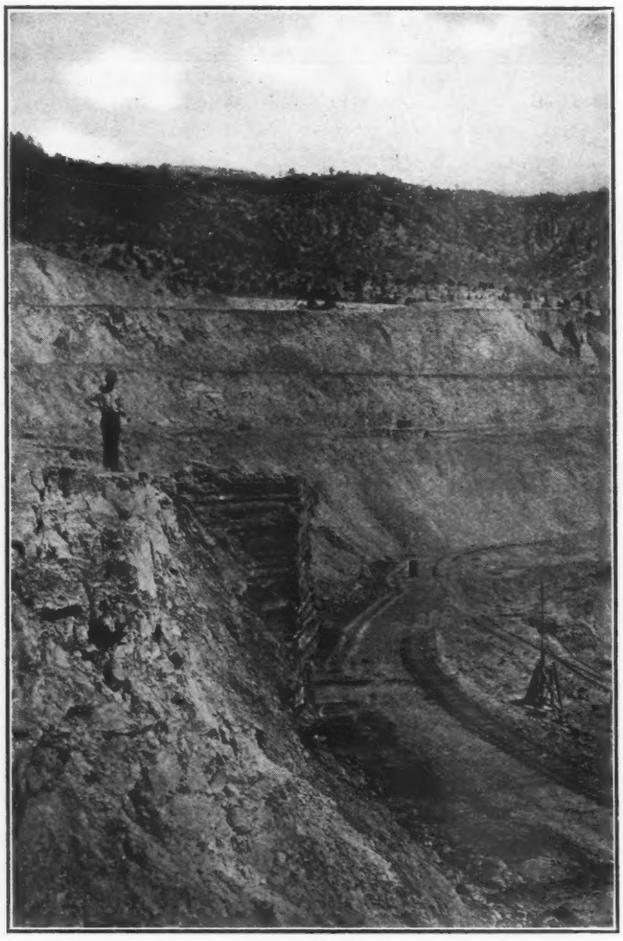
While at Santa Rita I was permitted to read the old copy book in which were recorded Mr. Thayer's letters and reports. To read such correspondence is to be reminded vividly of one's own experience as a manager of mines and to feel keen sympathy with the fellow engineer whose troubles and sorrows are so faithfully chronicled. The letters were addressed to the secretary of the company, Urban H. Broughton, the English son-in-law of H. H. Rogers. In his correspondence Mr. Thayer shows polite deference to suggestions from the New York office, even in the matter of starting crosscuts from the cross-country drift that was then being driven from the Hearst shaft. He was seeking "the footwall of the orebody," and he makes references to the hanging wall also, thereby indicating that he was proceeding on the idea of vein structure. How different were his views then from Mr. Sully's now, when the whole country for a width of half a mile lies exposed to the sunlight! Which simply proves that "ore" is an economic term and that the width of a lode is determined not by a tape but by assays.

A Big Orebody Just Missed

In the annual report dated June 8, 1901, the manager states that the Hearst estate, under the terms of the lease and option under which the property was held at the time of its purchase by the Santa Rita Company, was compelled to sink a shaft (the Carrasco, renamed the Hearst) to a depth of 300 ft. At 290 ft. a station was cut and a cross-country drift was started. When 300 ft. long this drift cut an orebody 10 ft. wide assaying 10 to 20 per cent. At the end of the year the drift was 540 ft. long and had cut into a contact between the "porphyry" and the "green formation"—the former being the limestone and the latter the granodiorite. Various sidedrifts or crosscuts were started to explore the ground. The cross-country drift came within 200 ft. of striking a bigger orebody than any that was found by the old company. This lies 500 ft. southwest of the Hearst shaft. It may be argued that if Mr. Thayer had gone through the altered limestone, or "greenstone," of the old days, there would have been no chance for the present Chino Copper Co., for he

would have cut into a width of 40 to 50 ft. of 10 to 12 per cent ore. All of which proves the wisdom of the Cornishman's adage: "Never quit until you have put in another round of holes." However, if the old company, under Mr. Thayer's management, had cut this orebody, and had made money for a time, the result probably would have been much the same in the end. The plan of working the property by leasing never would have developed it into a big mine.

The method of exploiting the Santa Rita copper deposit by following separate small veins of ore was doomed to failure, because the method was too costly



The remains of the old Spanish shaft

in proportion to the output. It is probable that other deposits of a similar kind elsewhere have been nibbled similarly by small-scale disconnected operations, and will become some day the subject of later mining methods on a generous scale. In such changes of technique lies the hope of developing the big mines of the future.

How the Chino Company Secured Control

The transfer of the Santa Rita mine to its present owner, the Chino Copper Co., was the consequence chiefly of an examination and report made by Mr. Sully. John Murchison Sully was graduated from the Massachusetts Institute of Technology in 1888. In 1902 he was superintendent of the Hite's Cove mine in Mariposa County, Calif. While thus engaged he met Donald McN. Palmer, a member of the General Electric Co.'s mining staff, of which Denis M. Riordan was the chief. Palmer must have formed a favorable impression of Sully, for in 1904, when Sully was in Alabama, he was engaged by Palmer as assistant to Joseph W. Bible, then superintendent for the Hermosa Copper Co., a subsidiary of the General Electric Co. in New Mexico. The Hermosa company owned the Ivanhoe group of claims, which adjoined the Santa Rita property on the south. That propinquity was the immediate cause of Mr. Sully's subsequent important connection with the Chino enterprise.

On his arrival at Hanover, Mr. Sully went to work at once. He was placed in charge of the development of the Ivanhoe and other claims that had been acquired by the Hermosa company. Besides the supervision of the explorations, he did such assaying as was necessary. Visits were made to Hanover by several engineers in the employ of the General Electric Co.; among them were E. Gybbon Spilsbury, John B. Kaeding, T. S. Mathis, Frank H. Probert, besides, of course, Mr. Riordan, who directed the mining investigations of the General Electric Co. for over twenty years. Sully had been on the ground for a year when he was asked by Bible, on a telegram sent by Riordan, to make an examination of the Santa Rita property, with a view to its possible acquisition by the General Electric Co.

Complete Report Made by J. M. Sully

The examination that Mr. Sully made of the Santa Rita was thorough and skilful. He took 4,300 samples, which were assayed at the Hermosa mine by George W. Cameron, who is now the Chino company's representative at the El Paso smelter. Duplicates were sent, for confirmation, to assay offices at El Paso and Denver. Sully completed his report in September. Thus the investigation consumed ten months. The cost of it was $10,000. In October Sully was informed that no favorable action would follow upon his report, which appeared, to some of the General Electric staff, to have absorbed too much time and trouble.

In the following month (November) Mr. Sully resigned and went to Mexico. The prospects of the Hermosa company did not seem good to him, and he found his position unpleasant. Five months later he returned from Mexico to Silver City, which is 16 miles from Santa Rita, but he went back to Chihuahua early in 1908. While in Mexico he made the acquaintance of a man named W. D. Pearce, who was killed in the Santa Isabel massacre in 1916. This Pearce was associated with the brokerage firm of Moore & Schley, who had built the Chihuahua & Pacific R.R. and were in touch with the financial group identified with the Standard Oil Co. Sully talked to Pearce about the Santa Rita, and expressed his confident conviction that it had the makings of a big mine. Pearce asked if he might see Sully's report, and intimated his desire to obtain an option on the property. Thereupon Sully, on his return to the United States, in April, 1907, wrote to Riordan asking for permission to use his Santa Rita report for the purpose of promoting a sale. Riordan replied that his company had no further interest in the matter and that he (Sully) was entirely at liberty to use the report in any way he might see fit, but Riordan suggested that Sully should obtain permission from the Santa Rita company as well. This procedure, I venture to add, was in entire accord with the high code of professional conduct followed by Mr. Riordan himself. So Mr. Sully, who respected his former chief highly, wrote to John Deegan, the superintendent of the Santa Rita, asking him to write to Albert C. Burrage, the president of the

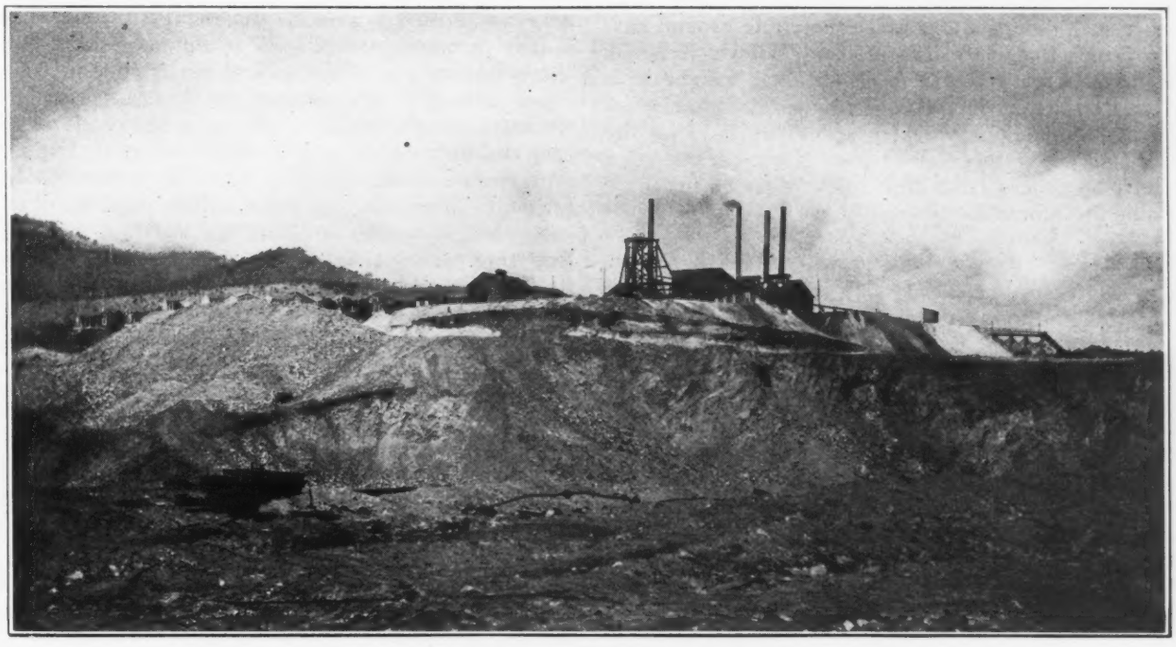
company, for the desired release. This was in April, 1908. If Sully had omitted this step he might have failed to get in touch with Burrage, in which event an essential link in the chain of events would have been lacking, as we shall see.

How Sully's Work Was Checked

While Sully was engaged as assistant to Spilsbury in an examination of the Little Fanny mine, in the Mogollon Mountains, he heard from Deegan that Walter H. Wiley, of Colorado, had arrived at Santa Rita for the purpose of checking his sampling. Would Sully be kind enough to let Wiley have his assay plans and the other maps that formed part of the report? In this letter, furthermore, Deegan stated that he had heard from Urban H. Broughton, vice-president of the Santa Rita company, and that Broughton gave Sully the permission to use his report as requested. Thereupon Sully, in May, 1908, went to Santa Rita and met Wiley, to whom he handed the various maps and other supplementary documents. Wiley was at the mine in behalf of Burrage and was checking Sully's report for that astute Boston financier. It was not long before Wiley, who did his own assaying, told Sully that his results agreed with those given in the report. Sully then received a telegram from Burrage, inviting him to come to Boston and asking him what would be his fee for doing so. The answer was $25 per diem and his expenses.

As soon as these telegrams had been exchanged, Sully proceeded promptly to Boston. Here I must explain that Burrage, although president of the Santa Rita company, did not see Sully's report when it was first made, because he was in Europe at the time. Later, at the end of 1907, Burrage happened to ask his associates, Broughton and Thayer, if they had a copy of the report, and finding that they had not, he went to Charles A. Coffin, president of the General Electric Co., who gave him the original text. He was so impressed by what he read that he asked Broughton and Thayer to send an engineer to confirm Sully's conclusions. C. C. Burger was selected for the task. He reported unfavorably, expressing disbelief in Sully's estimates of the ore available. However, Burrage was not impressed by Burger's report, and maintained his belief in Sully's opinion of the property. He asked Broughton and Thayer if they would permit him to send an engineer on his own account to make an examination. They acquiesced. It was then that he sent Wiley to Santa Rita.

As soon as Sully reached Boston he was cross-examined by Burrage, who asked him also what had been his previous experience, particularly in the smelting and marketing of copper. This was Sully's weak point, but he defended his position successfully, by explaining the steps he had taken to obviate the lack of experience in certain matters. Next Burrage introduced Sully to Thomas W. Lawson, who had not yet read the report on the Santa Rita, but showed keen interest in Burrage's statements. The result of these interviews was that Burrage commissioned Sully to return to the mine and bring the report up to date.



The Romero 6310 bench in 1904

Sully arrived at Santa Rita late in June, 1908, and found much new ground that had to be sampled. Burrage himself visited Santa Rita on July 7. He is a lawyer by profession, a capitalist by circumstance, a keen man of business, with an intensely active mind, but without technical training in matters pertaining to mining and metallurgy. During that year (1908) and in the early part of 1909, Sully examined a number of other mines for Burrage. Thus they became well acquainted. Sully took 6,000 more samples at Santa Rita, and was engaged in the labor of writing his supplementary report when, in October, he receieved a telegram from Burrage telling him to come again to Boston. He finished the report on the train. Soon after his arrival in Boston, an abstract of the report was made and submitted by Burrage to Hayden, Stone & Co., who already had become interested in the Utah Copper and Ray enterprises. Several interviews followed between Galen Stone, Burrage, and Sully. Wiley was called to Boston and joined the later conferences, to which

Charles Hayden also was a party. It was agreed to send yet another engineer to give a final opinion on the data contained in the reports by Sully and Wiley. This was to be done not on a sale of the property but preliminary to an issue of bonds to be underwritten by Hayden, Stone & Co. The name of J. Parke Channing was suggested, but he was believed to be not available and his connection with the Lewisohns, who were among the owners of the Santa Rita, was cited as an objection. Thereupon A. Chester Beatty was selected on the initiative of Mr. Hayden, with whom Mr. Beatty was then associated as consulting engineer. At that time Beatty was in the West, so it was arranged for Sully and Wiley to meet him at Deming, a railroad junction near Santa Rita. This was done.

The three engineers proceeded in company to the mine. Sully and Wiley discussed the relation of the dumps to the distribution of the ore and the inferential evidence such dumps might give concerning ground having workings that were inaccessible. Wiley's views on these matters were bound to carry great weight with Beatty, who listened critically to the discussions between his companions. Beatty spent two days on the ground and then proceeded to New York, accompanied by Sully, on orders from Burrage. Wiley returned to his home in Colorado.

Hayden, Stone & Co. Not Enthusiastic

More conferences followed. Beatty refused to commit himself. Burrage and Lawson were disgusted, because their options were about to expire. Hayden, Stone & Co. declined to underwrite the bonds. The business was near a fiasco. However, Burrage was not a man easily balked. His next step was to ask Sully to visit the Utah Copper to see what was being done there with the steam shovels. Then he asked Sully to examine a coal mine at Carthage, near Socorro, in New Mexico, with a view to obtaining fuel for power at the Santa Rita mine and for saving the nitrogen compound needed for the Bradley process, in which he and Lawson were interested. It was arranged also to start churn drills to explore the copper deposit and to check the sampling already done at Santa Rita. That was in November, 1908.

Promotion Plans of Thomas W. Lawson Fall Flat

Sully returned to Santa Rita and assisted Deegan in making sundry changes in the mill, which was treating dump ore, with no particular success. In 1908 a sum of $30,000 was remitted from the mine to Boston, but most of this was the profit made by the store. Sully was asked by Burrage to take charge of the property, and, after a demurrer—for he preferred not to be tied down—he accepted the appointment of "superintendent engineer in charge" on Feb. 20, 1909. Preparations were being made for obtaining data to be used in a campaign of promotion that Lawson was to conduct for the purpose of selling stock to the public. On May 1 the prospectus duly appeared. Although 65,000 copies were printed and distributed, the issue was a fizzle. The small amount of money collected by Lawson was returned to the few simpletons that had been caught by his bait. It had been intended by Lawson and Burrage to start a campaign in London, but they abandoned this idea when "the book fell flat." While Lawson was besmirching the fame of this historic mine by his antics, his partner, Burrage, had started negotiations with H. H. Rogers and others connected with the Anaconda Copper Mining Co. with a view to obtaining the working capital needed for carrying out the plans outlined in Sully's report. The Anaconda group held 50,000 shares, out 75,000, in the Santa Rita. Burrage and Lawson held the remaining 25,000. At that time Burrage had decided to stop all exploratory work, by drills or otherwise, and to mine the rich orebody in the Chino claim, with a view to erecting a plant for the Bradley process. Meanwhile Sully was visiting Beatty at his office from day to day, giving him the latest news from the mine and doing his best to hold the attention of Hayden, Stone & Co. Beatty counted upon the failure of Lawson and Burrage to raise fresh capital.

Matters drifted until May 20, 1909, when Burrage acknowledged the failure of the Lawson flotation and told Sully that papers were to be signed next day by Rogers, who had agreed to provide the requisite capital. Why, it may be asked, was Rogers so slow in taking hold of the enterprise, in which he and his friends were interested already? The answer is that his associates—Rockefeller, Lewisohn, and Broughton—were unwilling; they did not believe in Burrage and Lawson, and their own engineer, Thayer, had no faith in the optimistic estimates presented by Sully. Nevertheless, Burrage succeeded at length in enlisting the help of Rogers. But the hand of fate was thrust forth just when Rogers was about to invigorate the Santa Rita with the capital it needed to become a great mine. On Thursday, May 24, Burrage and Sully were congratulating each other on the near fulfillment of their plans; they left the Belmont hotel together, Burrage going to 26 Broadway, to meet Rogers there, Sully proceeding to 71 Broadway, to see Beatty. Thirty minutes later, while talking to Beatty, Sully received a telephone message from Burrage saying that Rogers had died at 6 o'clock that morning.

Hayden Stone Agree to Finance the Property

This was a great blow to Burrage, in several ways. Besides the shock of losing a friend so suddenly, he was frustrated in his plans for the Santa Rita. Nothing remained but to engage the interest of Hayden, Stone & Co. It was the last chance. Burrage would have put his own money into the venture, for he had faith in it, but just then he was not in a financial position to do so. Sully and Beatty continued their talks. Hayden, Stone & Co. showed signs of attention. Burrage's option on the majority stock expired on the following Monday, so the position was critical. It was saved in the nick of time. On Monday, at Boston, Hayden, Stone & Co. took over the options and agreed to proceed with the enterprise, as planned in Sully's report. It was agreed also that a new company was to be organized with a capital of 700,000 shares of $5 each, of which Burrage and Lawson were to receive 125,000 shares in lieu of their 25,000 shares in the old company. They would have made more if Burrage had concluded the deal with Rogers; Burrage lost control when Hayden and Stone took hold of the business. He was disappointed in being unable to apply the Bradley process, but that was the weakest part of his scheme. He tried to persuade Hayden and Stone to try the process, but they waved it aside, because both Beatty and Sully refused to consider any departure from established metallurgical practice. The keynote of the new plans was the use of the steam shovel for digging the

ore, as advocated by Sully in his original report of September, 1906.

A few days after the deal between Burrage and Hayden was closed at Boston, Sully started on his return to New Mexico, with Allen H. Rogers. They arrived at Santa Rita on June 6. Rogers forthwith began his examination of the mine for Hayden, Stone & Co. Sully continued to be "superintendent and engineer in charge." Beatty, as advisory engineer to Hayden and Stone, became *de facto* consulting engineer to the Santa Rita Mining Co., and Rogers acted under his instructions.

How the Value of the Mine Was Determined

In June (1909) the new company, the Chino Mining Co., was organized with 750,000 shares of $5, making a nominal capital of $3,500,000. This was a modest valuation of the mine, for it was a reasonable expectation that it would produce 5,000 tons a day, or 1,500,000 tons a year, for eight years. The operations were expected to yield a profit of $2,350,000 a year. Assuming that $5,000,000 would be spent on the mill and other equipment, the return would be $1,700,000 a year for the eight years, with a deference of two years. The sum of $1,700,000 for eight years, without deference, at 6 per cent interest and 4 per cent for reinvestment of dividends, is worth $10,000,000. Thus $1,700,000 a year is equivalent to 17 per cent gross on the $10,000,000. At 8 per cent interest and 6 per cent for reinvestment, the $1,700,000 a year would have a present value of only $9,000,000. On the basis of the Victorian method of valuing mines for the London market, with a sneaking glance at the unfathomed gullibility of an ignorant public, such a mine would be floated for $20,000,000. Lawson tried to float it for $21,000,000, and failed, because the methods used successfully by Baron Grant and Whitaker Wright were out of date in 1909, even in London.

The Chino mine has been in operation long enough to test the accuracy of the forecasts that were made by the various engineers at the time the enterprise was incubated. Of the various reports, the two by John M. Sully are much the most important, not only on account of their elaboration and thoroughness, but because they played a decisive part in the history of the enterprise. His first report, of 1906, as we have seen, was instrumental in engaging the interest of A. C. Burrage, and his second report, of 1908, enabled Mr. Burrage to obtain the financial assistance of Hayden, Stone & Co. The two reports were the *raison d'être* of the Chino Copper Co.

How the Samples Were Taken

Before starting his systematic sampling of the workings, in December, 1905, Mr. Sully took twenty-five samples, from points scattered all over the mine, to obtain a general idea of the distribution of the ore. These samples were broken with a moil and hammer; each of them was taken across a width of five feet; they included samples of the wall rocks and the stope fillings. The results showed the general dissemination of the copper, and indicated that a comprehensive examination was justified. As soon as he received the assay returns, he proceeded to organize his crew. He divided it into three gangs, each consisting of three Mexicans and an English-speaking boss. They reduced the samples in the mine to 500 lb. When the examination was completed there was fifty tons of rejected material at the assay office. This was sent to the Hermosa mill. "That was one thing," said Mr. Sully to me, "in which we were thoroughly drilled at the M.I.T.—the cutting down of samples." To which I have to add, that the Massachusetts Institute of Technology has reason to be proud of the manner in which this examination was performed by one of her graduates.

When sampling the dumps, a cut was not made right through, but it was noted that the effect of the slope was to produce a sorting effect, yielding samples of increasing coarseness toward the bottom or edge of the dumps. The taking of samples from the outside of a dump would be misleading if applied to a gold ore, but on a low-grade copper ore it does not lead to false inferences. The outside of a dump gives a sample of the last ore mined through the shaft from which it came.

A Model Report

The text of the report covers 70 pages of typewritten foolscap. It starts with a summary of the history of the Santa Rita mine; then follows a list of the claims inclined in the property, a brief description of the various shafts and other openings, with notes on the railroad facilities and the topography. These items of information occupy the first ten pages. Next comes the geology, to which eight pages are devoted. Then Mr. Sully gives a description of his manner of sampling. This covers three pages. As already stated, twenty-five preliminary samples were taken for the purpose of obtaining a correct idea of the true character of the deposit. These, says Mr. Sully in his report, "made it evident that while there were certain enrichments along larger fractures, there was also a general impregnation into the contacting rocks, due to its highly fractured character and fissility openings."

The sampling of a mine must be performed with an eye to the metallurgical treatment to which the ore is to be subjected, and the cost of such treatment; the engineer in charge of the sampling must foresee what will be "ore," restricting the use of this term to a metal-bearing rock that will yield a profit at the given time and place, and under the conditions predicated. It was necessary for Mr. Sully to know what recovery the Santa Rita mill was making and what recovery a better mill might be expected to make. So he asked N. C. Titus, the Hermosa company's mill superintendent, to sample the material that entered and that left the Santa Rita mill on a given day. This test showed that the mill was saving 46.75 per cent of the copper in the form of a 28.8 per cent concentrate. That this saving could be bettered easily was proved by a test made at the Hermosa mill. For this test Messrs. Sully and Titus used thirty-three tons of material left from the cutting down of samples, and to it they applied no elaborate apparatus—only an additional jig and a little more sizing. The saving was 69.5 per cent. This was the figure used in estimating the amount of copper to be recovered from the various orebodies, although it was anticipated that the regrinding of middling would yield an additional saving.

The assays were made by the volumetric, or iodide, method. The electrolytic assay was used as a confirmation. Furthermore, as already stated, many assays were sent to Denver and El Paso as a further check.

The assays were recorded on maps, of course, and a complete list of the returns, giving information concerning each place sampled, as well as the result, is

The beginning of steam shoveling in 1911

attached to the report. For his examination Mr. Sully required not only maps of the mine workings, which were given to him by the superintendent, but it was necessary that these workings be tied to the property lines. Therefore he caused a careful survey to be made. He describes the method adopted.

The orebodies are described and the results of sampling are applied to the estimated tonnages. This part of the report covers thirty-one pages. I shall quote from Mr. Sully's description of the Air Shaft orebody and show how he arrived at his estimate:

"The general average of all samples taken as being within reasonable limits of the ground to be taken out as the Air Shaft orebody is 3.87 per cent copper. Leaving out the freak or high assays, this average is found to be 3.45 per cent copper . . . In figuring this orebody the areas indicated by dotted lines on plans and sections were used, bearing in mind not only the danger of overestimation but also of underestimation, and keeping within the limits of the sampling. The area on the 150-ft. level as shown, is figured as 44,717 sq.ft., and on the 300-ft. level as 32,100 sq.ft. Assuming that the middle area between that of the 150-ft. level and the 300-ft. level is a mean proportional between the two, and sufficiently within the range of accuracy required, the middle section is found to be 37,886 sq.ft. Using the prismoidal formula and from the section finding the height of the prismoid to be 152 ft., we have

$$\frac{44{,}717 + (4 \times 37{,}886) + 32{,}100}{6} \times 152 = 5{,}785{,}120 \text{ cu.ft.}$$

"From the history, dumps, and character of the deposit, 50 ft. is taken as a conservative height to which ore can be figured above the 150-ft. level, while there is evidence that it extends to the surface or to only 10 or 15 ft. below. Fifty feet below the 300-ft. level is also considered fair, when taking the area as one-half that of the 200-ft. level:

	Previously estimated,	5,785,120 cu.ft
Above 150	$44{,}717 \times 50 =$	2,235,850 cu.ft.
Below 300	$\frac{32{,}100 + (4 \times 22{,}698) + 16{,}050}{6} \times 50 =$	1,157,850 cu.ft.
		9,178,820 cu.ft
9,178,820 cu.ft. @ 13 cu.ft per ton =		706,063 tons
Less extracted ore		100,000 tons
		606,063 tons

"Call this in round numbers 606,000 tons, assaying as stated above 3.45 per cent copper, or 69 lb. copper per ton:

$$606{,}000 \times 69 = 41{,}814{,}000 \text{ lb.}$$

"Figuring on a basis of the mill-test run in the Hermosa Copper Co.'s mill on 33 tons of ore obtained from quartering down the assay samples, the report of which accompanies this paper and showing a saving of 69.5 per cent,

$$41{,}814{,}000 \times 69.5 = 29{,}060{,}780 \text{ lb. copper saved.}$$

"Figuring on a 10 to 1 concentration: 606,000 tons of ore at 1:10 = 60,600 tons of concentrate, which would average $\frac{29{,}060{,}780}{60{,}600} = 479.5$ lb. per ton of concentrate, or a product carrying 23.97 per cent copper.

"Using basis of Silver City smelter rates with a deduction of 1 per cent, the actual market copper would be 479.5 — 20 = 459.5 lb. copper per ton of concentrate, and for the total concentrate product: $60{,}600 \times 459.5 = 27{,}845{,}700$ lb. of copper actually marketed and to be paid for."

At the close of this part of the report it is stated:

"It is evident from the description of the orebodies given in this report that there is a large tonnage of ore varying from 2.11 per cent copper to 3.45 per cent. These orebodies have been divided into two classes—namely, Developed Ore and Expectant Ore. The Developed Orebodies are those in which the work done has exposed the ore formation so thoroughly, and the average character of the ground is so completely established that there is no doubt whatever as to their existence. The Expectant Orebodies are those in which the workings have exposed two or more sides, but at such a distance apart that an element of uncertainty is suggested through inability to enter all the workings, though the ground has been sampled as completely as the openings would permit and has been substantiated by the average of the dumps. In the case of some of these Expectant Orebodies, all that prevented their being put in the first class was the fact that their workings could not be sampled and mapped in their entirety. Nevertheless, the evidence was practically absolute as to their extent and value. It is believed that the expectancy of this class is nearly if not quite 100 per cent, but for purposes of calculation throughout this report the expectancy has been assumed at 75 per cent in order to leave a factor of safety. Aside from these orebodies, others have been mentioned which have been sampled on at least one side, but on which no figures could be made. Mineralized areas have also been indicated by shallow workings and dumps. These deposits and outcrops promise, on development, to add much to the future value of the property."

Next come two tabulated statements of the ore tonnages and the operating costs, the first dealing with the developed and the second with the expectant[1] ore.

Mr. Sully's own summary of these tabulated statements is as follows:

Summary of Preceding Tables

	Developed Ore	Expectant Ore
Total tonnage of ore bodies, tons	3,217,060	5,745,034
Average copper content per cent	2.73	2.39
Total copper content, lb.	175,781,160	275,188,310
Copper saved in mill (69.5 per cent), lb.	122,166,910	191,205,850
Concentrates made, tons	296,765	486,269
Copper actually marketed, lb.	116,422,070	181,457,800
Total cost ore delivered to mill	$4,732,698.25	$5,455,439.00
Total cost of milling	2,412,795.00	4,308,785.50
Total cost, freight and treatment	1,003,677.50	1,701,941.50
Total cost	$8,149,170.75	$11,466,166.00
Average cost per pound copper marketed	$0.07	$0.0632
Smelter deduction from quotation, representing cost of converting and New York delivery	0.025	0.025
Total cost per pound copper delivered New York	$0.095	$0.0882

The report proceeds to say:

"As an illustration, from the items given above, the present net value of the orebodies can be figured, using the present average New York quotation of 18c. per pound for casting copper. In the case of the developed ore, the total average cost of mining, milling, smelting, and New York delivery is 9½c. per pound of copper. Taking this from the New York price, the net profit over operating and marketing expenses is found to be 8½c. per pound. Multiplying the total copper to be marketed, 116,422,070 lb., by the net profit per pound, the total profit over operating and marketing expenses would be $9,895,875.95. This figure represents the present value of the developed orebody. For the expectant orebodies the total cost of mining, milling, smelting, and New York delivery is 8 92/100c. per pound copper marketed. The net profit is, therefore, 9 18/100c. per pound. Multiplying the total copper to be marketed, 181,457,300 lb., by this net profit per pound, the total profit would be $16,657,826. As the expectancy is taken at 75 per cent, multiplying this by 0.75, and the result $12,493,370, is the present value of the expectant ore.

"It will take twenty-eight years to work out these two classes of orebodies, assuming 313 working days per year. Take the percentage of return on the capitalization, or present value of the orebodies, and the improvement account of $1,000,000, as 10 per cent per annum extending over the period of twenty-eight years; take the expectancy as 75 per cent. The total number of pounds of copper marketed (shown by previous calculation of expectant orebody) is 181,457,800, at a total cost of 8 52/100c. per pound. Then 14 — 8.82 = 5.18c., profit per pound, copper delivered in New York. 181,457,800 × 0.0518 = $9,255,514, total profit copper delivered in New York. As expectancy = 75 per cent, 9,255,514 × 0.75 = $6,941,635, value of expectant orebody.

Value developed orebodies	$5,238,993
Value expectant orebodies	6,941,635
Total value of orebodies	$12,180,628

"Now let V represent the value of the property. The improvement investment required has been shown to be $1,000,000.

Then V + 1,000,000 = total investment required.

"As it will take a 1,000-ton mill twenty-eight years to produce the value of the orebodies, and 10 per cent per annum is assumed as the interest expected, the total to be paid by the values shown above is as follows:

280% + 100% = 380%, or 3.8 times V + 1,000,000;
Therefore 3.8 (V + 1,000,000) = 12,180,628;
Whence V + 1,000,000 = 3,205,428;
And V = 2,205,428.

"Therefore the present value of the property is, under the assumptions made, $2,205,428."

He discusses the manner in which the property was being operated at that time, and recommends continuing the leases pending preparations for working on a

[1]By the way, "expected" would be better, because "expectant" means to be in the state of mind of expecting; it is the engineer, not the ore, that is "expectant."

Prospecting drill on the edge of the orebody

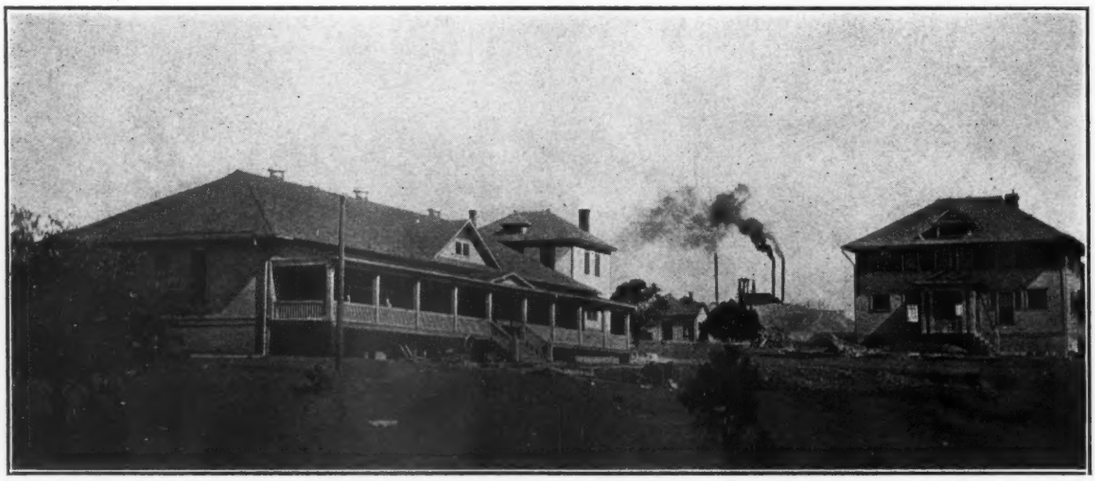
larger scale on company account. His conclusion reads as follows:

"Reviewing the facts set forth in the foregoing pages, it has been shown the property is favorably located and has ample railroad facilities already provided; that its geological relations are favorable, not only for lateral exploration at the depths already attained but for a continuation of values at greater depth; and that the property is of sufficient extent to completely cover the mineralized area. Development work has been carried on to such a point that large bodies of ore are assured, and still other areas promise well for the future. It has been shown that the ores can be concentrated with economical results. Demonstration has been made in detail as to the extent and value of the orebodies, cost of producing the copper, and as to the steps necessary to take in order to put the property on a paying basis. To sum up, this property has been shown to have a total of nearly 9,000,000 tons of ore, containing nearly 451,000,000 lb. copper, of which, even taking a mill saving of 69.5 per cent when better results should be obtained, 298,000,000 lb. would be produced and placed in New York at a total cost of 9.1c. per pound. With a 1,000-ton concentrating mill, these orebodies insure a twenty-eight-year life, and with a reasonable price for the property, the investment and 10 per cent per annum, would be returned by the ore in the period named. Aside from these orebodies, it has been shown that others exist of at least equal value, for which no tonnage could be figured, but which represent the speculative value, though much more certain than chances ordinarily taken in mining investments. As the orebodies to which tonnages are assigned, have, and still do contain rich shoots, it is unreasonable to expect other than the same enrichment in the undeveloped bodies. In view of the facts, it is concluded that this property has the value and certainty of a successful commercial enterprise at the same time not losing the speculative features that surround a purely mining proposition, and no hesitation is had in earnestly recommending it to careful consideration."

The proof of the pudding is in the eating, the test of a report is the subsequent performance of the mine. The record of the Chino enterprise bespeaks the trust worthiness of Mr. Sully's report. I regret that the exigencies of space prevent me from quoting any large part of Mr. Sully's second report, written in October, 1908. By that time he had more information, based on later exploratory work, so that the estimate of ore in reserve was raised to 12,000,000 tons, averaging 1.63 per cent copper, which, he estimated, would be marketed at a cost of 8.27c. per pound of metal, at a total profit of $18,500,000. These estimates have been amply fulfilled, as the following record shows:

Year	Tons Ore in Reserve, At End of Year	Average Copper per Ton Ore in Reserve, per Cent	Ore Milled, Tons	Average Milled Daily, Tons	Average Copper per Ton Ore Milled, per Cent	Copper Recovered per Ton Ore, Lb.	Copper Recovered, per Cent	Total Net Copper Produced, Lb.	Average Cost per Lb. of Copper Produced After Crediting Precious Metals and Miscellaneous Income, Cents	Average Price per Lb. Produced, Cents	Net Profit Miscellaneous Income, etc.	Disbursements to Stockholders	Surplus From Operations at End of Year
1911	54,970,646	2.24	.....	.....	.....	.....	.....	986,375	.....	13.30	$118,472.75	.....	$284,445.72
1912	90,000,000	1.80	1,120,375	3,061	2.077	25.60	61.63	27,776,088	(a) 7.23	15.6403	2,176,904.42	.....	2,461,350.14
1913	90,000,000	1.80	1,942,700	5,322	2.033	27.37	67.31	50,511,661	(a) 8.49	15.0884	3,234,033.51	$1,919,070.00	3,743,167.09
1914	90,270,155	1.75	1,907,300	5,225	2.115	28.70	67.858	53,999,928	(a) 7.35	13.325	3,222,579.10	2,169,065.00	4,566,401.97
1915	90,000,000	1.75	2,379,800	6,520	2.155	28.69	66.588	64,887,788	(a) 6.75	17.42	6,913,983.87	2,609,860.00	8,613,260.58
1916	95,555,843	1.656	3,094,400	8,455	1.83	24.42	66.59	72,319,508	(a) 8.706	26.465	12,843,161.73	7,177,335.00	13,963,873.80
1917	95,555,843	1.656	3,608,100	9,885	1.64	22.70	69.32	79,636,235	(b) 11.39	24.116	9,512,854.28	8,612,802.00	14,863,926.08
1918	96,552,026	1.63	3,836,400	10,510	1.63	20.67	63.275	75,655,641	(c) 14.02	22.536	3,908,222.25	3,914,910.00	14,857,238.33
1919	94,781,525	1.62	1,765,200	4,836	1.82	23.97	65.67	40,488,706	(d) 15.314	18.05	1,301,797.03	2,609,940.00	13,549,095.36
1920	105,689,247	1.53	1,838,140	5,022	1.76	24.93	70.67	44,051,849	(d) 14.40	17.397	1,319,540.54	978,727.50	13,889,908.40
1921	105,385,461	1.53	361,660	3,546	1.70	26.28	77.36	9,137,282	(e) 14.50	13.026	(f) 1,314,204.72	.....	12,575,703.68
1922	103,965,894	1.523	1,416,869	5,267	1.55	20.83	66.99	28,406,314	(e) 11.20	13.636	(f) 848,785.57	.....	11,726,918.11
Totals			23,270,944					547,857,375			42,388,559.19	29,991,709.50	

(a) The costs prior to 1917 include all taxes which were minimum, but do not include depreciation of plants and equipment.
(b) The cost of 11.39c. includes depreciation of plants and equipment and part of the Federal taxes.
(c) The cost of 14.02c. includes depreciation of plants and equipment and all taxes except Federal.
(d) The cost of 15.314c. includes depreciation of plants and equipment and all taxes except Federal Income and Profit taxes, for which no reserves were set up in 1919, or in 1920. Therefore same conditions apply to 1920 costs of 14.40c.
(e) Excludes reserves for Federal taxes and charges for depreciation.
(f) Loss.



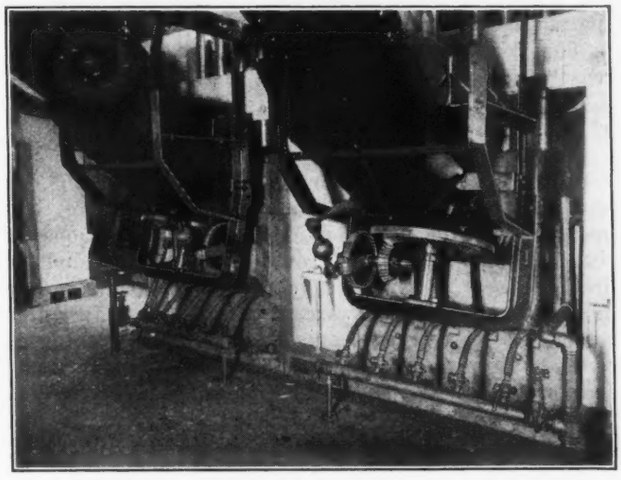
Dormitory and mess house at Santa Rita

USEFUL OPERATING IDEAS

A Neat Arrangement for Feeding Water to a Stamp Battery

BY FELIX EDGAR WORMSER

The new South Mill of the Homestake Mining Co. at Lead, S. D., has a means of feeding water to the stamp batteries which overcomes the injurious effects of vibration on the piping usually used. As can be seen in the photograph, each battery of five stamps is provided with a water-feed pipe having five valves which



Homestake method of feeding water to stamps
Rubber hose in short lengths takes up the vibration.

regulate the amount of water furnished to each stamp. The valves are screwed on nipples welded to the feed pipe, each of them having a flexible rubber hose extending to the battery box. They take up the vibration, which ordinarily gives severe punishment to the iron piping commonly used.

How Fire Protection Is Maintained at the Timber Butte Mill

BY W. J. TAIT

The following method of organized teams competing in fire drills and maintenance of equipment has been developed at the Timber Butte mill and has been successful in securing more careful maintenance of equipment and the reduction of fire hazards.

The concentrator is operated twenty-four hours a day by three shifts. The buildings are of frame construction, with concrete foundations and concrete floors next the foundations. All buildings are protected by automatic sprinkler systems, by interior hose and extinguishers, and by outside hydrants with standard hose equipment. The sprinkler system and hydrants are attached to a system of high-pressure fire mains, maintained solely for fire protection. Water for the fire mains is supplied from two independent sources by an automatic pressure-governed pump and a 50,000-gal. storage tank. Some of the mill pumps are arranged so that they may be used in conjunction with the fire pump.

A daily inspection of all fire protection equipment is made and reported, but this inspection has become perfunctory, for the reason that the fire organization has been perfected. The organization for fire fighting is headed by a fire chief, whose duties, in his absence, devolve upon a definite succession of men in responsible positions. Under the fire chief are nine fire teams of five men each, six being captained by shift bosses in the mill, two on each shift. The other three teams, recruited from the shops, the yard, and the repair crews, are all on the day shift.

The yard area, the crushing plant, the mill, and the shop buildings are divided into three divisions; each division is divided into three districts; and the nine teams are each given a district in which they are responsible for the maintenance of equipment and the elimination of fire hazard. Each of the three teams in a division occupies the three districts in rotation, spending a month in each district. The divisions are so formed that the shift bosses are not called out of their regular working territory, and yet each man covers all that part of the mill over which he has authority.

During the warm months each team has a monthly hose drill. These drills are judged and graded by certain designated officials, on the handling of equipment, team work shown, and speed, the greater emphasis being put on the handling of equipment. The log of the drill, with the remarks and grading of the judge, is filed. Each captain makes out a monthly report on the equipment and general condition of his district, and this is supplemented by an inspection and report from each of the three shift foremen. The three shift foremen award independent grades based on their inspections, and the average is entered as the team grade.

Sometime during the year each team is examined as to its general knowledge of the fire protection system. The examination covers water supply, pumping equipment, the location and operation of the various control valves, the use of fire extinguishers, the functions of the automatic sprinkler systems, and all subjects allied to fire protection. These points are all covered in "The Fire Manual," a booklet issued by the company and supplied to each employee. In addition to this, plats of the fire system are posted about the plant and given to each team captain. Teams may also gain points by making suggestions for improvements in fire protection. These suggestions are made on the monthly report sheets. Composite team standings are made from month to month on the following basis: Hose drills, 20 per cent; maintenance, 40 per cent; examination, 30 per cent; suggestion, 10 per cent.

Cash prizes are awarded quarterly to the four teams having the highest standings. Changes in personnel and operating conditions make longer periods than three months undesirable.

THE PETROLEUM INDUSTRY

Effects of Close Spacing of Wells Pointed Out by Mines Bureau

"Town-Lot" Drilling in Southern California Draws Comment of Engineers—Economical Production Dependent on Scientific Development of New Fields

UNUSUALLY CLOSE SPACING of oil wells, or what is known as "town-lot drilling," has been responsible for great wastes of oil and for large monetary losses to investors in the development of many petroleum fields in the United States, according to the U. S. Bureau of Mines. Town-lot drilling has recently become a factor in the development of the new fields of southern California. Wells are being drilled in the Santa Fé Springs field on adjacent town lots, some of which are not more than 120 ft. square. Because of the great depth and the high cost of these wells, the cost of developing this field will be excessive, and many wells doubtless will not pay for themselves.

The Burkburnett townsite pool in Texas furnishes a typical example of losses and wastes from close drilling. Within six months after the first well was drilled, the average initial daily production per well had dropped from 2,000 bbl. to 300 bbl; within a year the average initial production was only 38 bbl. a day per well. In the townsite proper, the average spacing was less than 1 acre per well.

Flush Production Dependent on Initial Drilling

The spacing of wells is an economic problem which is governed by many factors, states the Bureau. These include the profits that may be derived, the recoverable amount of oil or gas, the porosity, saturation, and thickness of the producing sands, the extent and structure of the productive area, the gravity of the oil, gas pressure, and depth. Theoretically, the closer the spacing the greater the ultimate recovery of oil from oil sand. However, the many factors opposed to close spacing far outweigh the possible benefits of greater recovery.

The term "town-lot drilling" has been applied to unusually close spacing of oil wells and implies the influence of promotion schemes. Town-lot drilling usually is not practiced by bona fide operators except when necessary for the protection of their property. Unscruplous promoters often sell parcels of land far too small to warrant the drilling of a well from an economic standpoint, causing adjacent operators to drill an unnecessary large number of wells to protect their holdings against drainage. Speed in getting a well into the pay sand is a prime requisite, because the first well in any locality benefits by obtaining the flush production. It often happens that a well will produce more oil during the first ten days or two weeks than can afterward be pumped in a year or more. Extreme speed in drilling is largely responsible for the waste that always accompanies town-lot drilling. To be the first to drill into the pay sand, careless and inexperienced operators often neglect to shut off water properly and to protect sands; hence wastes from infiltration of water, dissipation of gas, and the migration of oil and gas are often tremendous. Another waste occurs because of the unprofitable yield of many wells and the carelessness with which they are abandoned.

Although oil can be recovered more rapidly and in larger amounts with a greater number of wells if they are drilled before the gas pressure is reduced, too rapid exhaustion of oil and gas may cause the rapid approach of edge-water. During its encroachment, the edge-water may "pocket" large quantities of oil. When wells are spaced too closely, the gas pressure, which causes oil to flow to a well, declines rapidly and the wells soon cease to flow.

Government Regulations Provide One Well to 367 Acres

Spacing varies in different fields, and no set rule can be laid down that will necessarily apply to more than one field. On government lands, the regulations of the Interior Department provide that no well shall be drilled closer than 200 ft. to the outer boundary line of the lease or permit, except along a boundary line common to non-government land. If this spacing is carried out on the rectangular system it will provide an area of 3.67 acres per well. Operators in Cat Creek field, Montana, agreed on a spacing of 440 ft. or 4.44 acres per well, as most economical. In the Slick field, in Oklahoma, one well to 10 acres has been the rule, but as the wells are spaced only 220 ft. from the line a large area is left in the center of each 40 acres, and there a fifth well could be profitably drilled on many 40's which would reduce the drainage area to 8 acres per well. The Bureau of Mines has estimated that 7 acres per well is too close for the Eldorado field, in Arkansas. Statistics for proved and completely drilled areas in California show the following acreage per well: Kern River, 3.4 acres; McKittrick, 5 acres; Ventura-Newhall, 4.8 acres; and Salt Lake, Los Angeles, 3.8 acres.

The U. S. Bureau of Mines has shown that delay in drilling results in loss of recoverable oil because of reduced gas pressure. It is also pointed out that widely spaced wells have a larger ultimate production, but the production per acre for the tract as a whole is much smaller than when wells are closely spaced. It is, therefore, just as important not to overspace wells as it is not to space them too closely. Overspacing decreases the amount of recoverable oil; underspacing usually causes financial loss.

The Interior Department prefers that lessees adopt a normal and reasonable drilling campaign by which the greatest amount of oil can be recovered with the least waste. Although the government is anxious to have the maximum amount of oil recovered, it realizes that an economic balance must be struck whereby the cost of recovery is not excessive with respect to the value of the oil recovered.

Texas Ichthyol Deposit To Be Exploited by Denver Capitalists

According to a news report from Austin, Tex., capital to the amount of $500,000 has been raised in Denver, Colo., for the development of a deposit near Burnet, Burnet County, Tex., which is reported to be rich in ichthyol.

Ichthyol, according to Sir Edward Thorpe, in his "A Dictionary of Applied Chemistry," is a pharmaceutical product of oily consistency, distilled from fossilized fish remains found in the Tyrol, on the coast of the Adriatic, and in other places in Europe. The chief source of the crude product is the Seefeld district, between southern Bavaria and Tyrol, where it has been long used as an antiseptic. The crude "rock oil" is obtained by simple distillation from the shale or "stink stein," a bituminous substance of grayish color. It is extensively used by the medical profession.

The Texas deposit, claimed to be the only one in the United States, covers 1,700 acres. The "ore" is said to be grayish in color, contains many marine fossils, and when broken open reveals a thick, black, oily substance. Plans are under way, it is stated, for the installation of a modern commercial extraction plant near Burnet.

As one of the largest plants in Europe produces only 3,000 kilos. per year (Thorpe), it appears likely that a plant with capacity justifying the investment of $500,000 will flood the market, as the reported price of the product in most parts of the United States is $5 to $10 per pound.

Fort Norman Oil Field Not Abandoned

The rumor that the Imperial Oil Co. has finally abandoned its exploration work in the Fort Norman field, caused by the removal of men and gear on the last boat up the Mackenzie River, has been definitely contradicted by A. McQueen, vice-president of the company. Mr. McQueen said that it was the present intention of the directors to send at least one crew to Fort Norman next spring, for the purpose of deepening the Discovery well or boring another well alongside of it. The Discovery well was deepened to 951 ft. this season, and now is capable of producing 60 to 70 bbl. per day. Wells "C" and "D" were dry and consequently have been abandoned.

Continuing, Mr. McQueen stated that in southern Alberta two wells were being sunk on the Dingman property, near Okotoks, south of Calgary, and one well was being sunk on the Rogers lease, four miles north of the Montana boundary. He stated further that the new refinery at Calgary was practically finished, and would be put in operation in November. About 50,000 bbl. of crude oil is already in storage at the new plant. It is probable that the refinery will be run on a mixture of high-grade Salt Creek oil and low grade Montana crude.

Depth Records in Californian Oil Wells

The Dobyns No. 3 well of the Shell company, in the Long Beach oil field, California, was recently placed on production from a depth of 5,450 ft. and it is reported to be yielding 3,600 bbl. per day. Plans are being made to bring in the Clock & McWhinney No. 1 well of the General Petroleum Corporation in the near future from a depth of 5,959 ft.

Search for Petroleum in Italy Encouraged by Reports of Geologists

The search for petroleum in Italy was authorized only a little more than a year ago, according to a report by the Italian Minister of Agriculture forwarded to the Department of Commerce from Rome. Up to that time the explorations made were practically limited to the Valle Latina, the districts of Ripi and Frusinate, where satisfactory results from the preliminary investigations were obtained.

Following the publication of the decree of Nov. 19, 1921, the country was divided into zones, the study of each of which was assigned to a geologist of recognized standing. The results of these studies have been encouraging, and in Emilia, Lazie, the Abruzzi, the Avelline, Basilicata and Sicily important indications of the existence of hydrocarbons have been found which make drilling advisable. Drilling has already been begun in the zones where technical reports as to the geologic formations are available.

In the systematic exploration of Italy for petroleum, the State will carry on the work directly only where it seems desirable on account of the importance of the zone to be explored or where such a large element of risk is involved that private enterprise would not be attracted.

Foreign companies will have the right to obtain concessions for specified territory under the same conditions as Italian companies, it is said, but everything that savors of monopoly or special privilege will be eliminated and such organizations as undertake to perform exploration and development work must furnish satisfactory guarantees.

It is intended to follow the same plan of action in the Italian colonies as in Italy proper, especially in Tripoli, after new and accurate geological studies have been made.

To Look for Oil in Newfoundland

Serious effort will be made in the spring of 1924 to develop the oil fields lying along the west coast of Newfoundland, according to a report forwarded to the United States Department of Commerce by Edwin N. Gunsaulus, United States consul general at Halifax. These fields comprise two distinct areas, one at Parsons Pond, with an adjacent smaller field east of Parsons Pond and south of White Bay. This area totals about 200,000 acres, approximately 75,000 of which have been taken up by development companies which have made investigations in the region.

The second area is situated north of Hawk Bay and comprises about 25,000 acres. An oil expert with experience in American fields is on an inspection trip to Newfoundland in the interest of a syndicate headed by George E. Bearns and C. A. Furu, of London, England, and D. H. Eaton, of Toronto. A survey will also be made of the property owned by Sir Mortimer Davis, head of the Imperial Tobacco Company Ltd., of London, England. The Bearns property includes the area at Hawk Bay and in addition thereto 50,500 acres at Parsons Pond.

Sir Mortimer Davis' interests are 6,500 acres south of the Bearns holdings and 12,800 acres south of White Bay. The Reid Newfoundland Co. also owns a large tract of territory in the vicinity. The property is about 20 miles north in a general direction of the site of the Armstrong Whitworth Humber mouth.

DISCUSSION

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

Conditions Improving for Mining Ventures in Siberia

Government Is Stable and Reasonable as to Taxation Requirements, and Labor Efficient and Plentiful, Declares Operator Returning to United States

THE EDITOR:

Sir—I arrived in San Francisco a few days ago after spending four to five months in Russia and Siberia, and have just read with interest the excellent article on the present status of gold mining in eastern Siberia, by A. P. Sviridoff; also your editorial on the status of mining in Siberia. There is little that I can add to Mr. Sviridoff's complete data and information on eastern Siberia, excepting that it might be of general interest to the mining fraternity to know present-day conditions in Siberia from a mine-operation standpoint.

During the last season I have been in charge of a small dredge operating in the Buria mining district of eastern Siberia. This small 2-cu.ft. bucket dredge, in so far as I know, is the only dredge actually operating in eastern Siberia at the present time. This dredge began operations in the early part of June and will close down for the season about the middle of November. In this particular area, it is possible to begin dredging by May 1, and with reasonable provisions, a full six months' operating season can be assured. A possibly longer season might be obtained with adequate heating and thawing facilities. The gravels throughout this particular area of Siberia are 90 per cent unfrozen and easily worked. The average depth to bedrock ranges from 12 to 22 ft.; there are no large boulders, and bedrock generally is schist with an occasional lime and slate intrusion. Values are from 30c. to 60c. per cu.yd.

What will probably be of general interest to the mining fraternity is a brief outline of the conditions under which it is possible for foreign mining companies to now operate on in Siberia. Any property which the company desires to operate must be secured in concession from from the Chita Government of what was formerly the Far Eastern Republic. Any concessions originated in Siberia should have the approval of the Chita authorities, but the concession and all of its terms and conditions must also be ratified and approved by the Soviet Government in Moscow. Under our concession agreement, we pay a royalty of 5 per cent of our gross output to the government. Local taxation, though not in the form of percentage, will amount to approximately 1 per cent on the gross output. The government agrees in this concession that local taxation from all sources shall not exceed 2½ per cent. The general tendency of local taxation is downward, as Russian operators pay under the same law and there has been strong protest against even this amount of taxation. The government also agrees that general taxation—that is to say, possible profits tax, capital tax, or any other form of general taxation—in the aggregate shall not exceed certain fixed percentage of the profits of the company after depreciation and amortization have been provided for. We have also, of our own volition, acquired through lease the rights of the former private owners of the properties, which we are now working and others which we plan in the future to operate. We pay the former private owners a 7½ per cent royalty on the gross output after the government royalty has been deducted. The government officers inform us that they do not consider it necessary for companies securing concessions to obtain rights from the former private owners, but they state that they have no objections to companies doing this should they so elect. We have considered it a matter of good policy, however, to secure the former private owner's rights, as this eliminates all local friction and secures the co-operation as well as the former data of the private owners. The amount of royalty which it is necessary to pay private owners varies with the particular property, and private ownership rights can be secured on as low as a 3 per cent royalty basis, and a 5 per cent royalty is generally considered fair and reasonable.

The gold produced from operations is sold to the state banks, which are now operating in all the principal towns and cities of Siberia. Under our agreement with the government, we are paid by the state banks for gold sold to them in either British pounds sterling exchange, or in American exchange. The market price of the gold is determined by assay and is based on the international quotations. It is possible under concession agreements to export your own gold.

During the last season I spent a short time in Moscow and have traveled across Russia and Siberia and have also voyaged a good many thousand miles throughout the interior of Siberia, and have had no difficulties of any kind. I did not observe any cases of robbery or violence during my sojourn in the country. As an example of the good law and order existant, I might say that we ship our gold from the mine in twenty- and forty-pound lot shipments a distance of five hundred miles to the nearest large city with operating bank and assay offices. We simply deliver our gold to the captain of one of the small river steamers that pass our mines and he turns it into the bank.

Throughout the cities of eastern Siberia, trade in general is active again. There are excellent stores in all of the principal towns and cities, and it is possible to purchase nearly all the necessary foods and supplies at a reasonable cost. The banks are flourishing and doing an excellent business.

Throughout Siberia all currency is gold and silver, silver predominating, with gold currency scarce and difficult to obtain. In Siberia, the paper ruble, with

its indeterminate value, is not in evidence. During the last year the government has introduced a new form of currency known as the Chervonetz. This is a ten-ruble gold note, equivalent to $5 in American money or the British pound sterling. This note is accepted at its face value in payment of obligations to the government or to banks, and during the time that I was there was quoted at par. The government banks have gold reserve of approximately 32 per cent in support of this currency and are steadily increasing this gold reserve protection. In European Russia the old issues of paper rubles are being gradually taken up by the 1923 currency and the ciphers have been cut off the new currency, so that it has been greatly simplified.

The transportation systems of Russia have shown strong and marked improvement in the last year. The Trans-Siberian Express has a once-a-week service between Moscow and Chita. This trip takes seven and a half days, which is practically pre-war schedule. Railroad fare is very low—first-class ticket, with one-half a coupé sleeping compartments, costs from Moscow to Chita $48 gold; second class, which is almost equally comfortable, $30 gold. A great deal of travel in eastern Siberia is by means of river steamers. These are comfortable, but not as good as our American ships.

It is now possible to go from New York to Chita, Siberia, in eighteen days. From Chita to Shanghai would be six days additional.

The present labor laws are complicated, but are being gradually reformed and simplified. They are designed primarily for the protection of the workman, but in the practical working out of these laws we found only small difficulties. There is abundant supply of labor, and the quality of labor which was in employment at our property was entirely satisfactory and competent. Our scale of wages, which, incidentally, is extremely high for the country under present conditions, was $67.50 gold monthly for winchmen and mechanics and engineers, and $45 monthly for ordinary mine labor. The workman boards himself out of this wage. I found the Russian winchmen and engineers entirely competent, careful, and faithful. The mechanics and engineers are much slower in their work than our corresponding labor, but they are much more exact and are careful to see that anything they undertake is properly executed.

While in Moscow, I interviewed several of the leaders of the Communist Government and they informed me that they are keenly desirous of having foreign capital, particularly American, to exploit their mining resources, and assured me that such capital would be given full protection. Also that any agreement which might be entered into with the government would be faithfully carried out. During the time that I was in the country, I talked with many representative foreigners and also endeavored to secure from Russians of all classes and conditions their opinions as to the stability of the present Soviet Government. The complete consensus of opinion, without one dissenting voice, was that the present Soviet Government is stable and sound and that there will be no change in the existing government for many years. There is not the slightest ripple on the surface of the waters which would indicate any unrest or any danger of revolution. The Russian people say that what will happen is evolution out of the present system and not revolution. As indicative of this trend, every change which has been made in the existing order within the last two years has been toward a more reasonable and conservative order.

A friendly spirit is evident everywhere toward America and Americans. This is based upon the long traditional friendship between Russia and America; also upon America's altruistic viewpoint throughout the Great War and upon America's generosity during the recent famine in Russia. A good evidence of the friendly attitude of the Russian people toward Americans in general, is that through all the bloodshed and turmoil of the last six years of revolution I do not know of any American being killed. Contrast this with Mexico under almost similar revolutionary conditions.

My personal impression is that capital is now reasonably safe in considering mining ventures in Russia. There is also no question in my mind that the Siberian placer fields offer today unexcelled opportunities for development.

R. D. ADAMS.

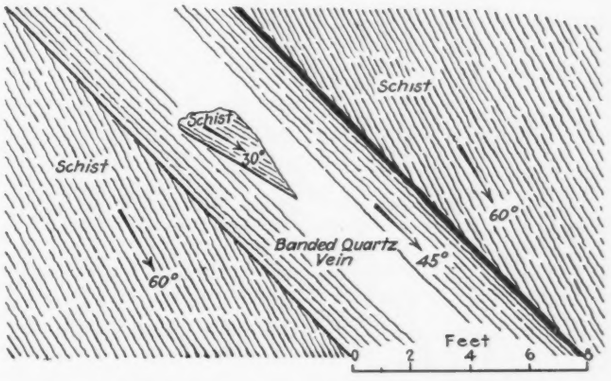
San Francisco, Calif.

The Filling of Fissure Veins

THE EDITOR:

Sir—Your article entitled "The Filling of Fissure Veins," page 329, of the *Journal-Press* of Aug. 25, 1923, is of great interest to me.

The accompanying sketch shows a condition I found in drifting on the Columbia vein in this county several years ago, and I think it very difficult to find an orthodox explanation for it. This occurred at a depth of 450 ft. on the vein, and is in pre-Cambrian formation. I have found other conditions, particularly in the close observation of ore banding and the "gouges," that make me skeptical as to accepted beliefs; and have caused me to theorize for my own benefit. However, I am not a geologist and will not presume upon your patience by enlarging upon my own theories here.



Suspended fragment of wall rock in Columbia vein

Thomson, Ga. W. H. FLUKER.

[Note: The sketch by Mr. Fluker indicates a fragment brought in by the gold-quartz magma from a point outside of (presumably below) the section shown, and held suspended in the magma till the magma consolidated or "froze." The case is very similar to that of the first figure in my article on the Filling of Fissure Veins, in the issue of Aug. 25 (page 329) showing the Amethyst vein, in Creede, Colorado (after Emmons and Larson); and also to the case shown in Fig. 26, Vol. I, of my book on Ore Magmas—showing the Griffith vein, Georgetown, Colorado. The gold-quartz veins of Georgia are in general intrusive, like the gold-quartz veins of Canada, such as those described in my article on the Gold Ores of Porcupine in the Oct. 13 issue of this journal.—J. E. SPURR.]

CONSULTATION

Determining Native Copper in a Chalcocite-Copper Concentrate

"Can you tell me the best method to determine the amount of native copper in a concentrate composed of chalcocite and native copper? Do you know of some book which describes this method. If you know of one, or the *Journal-Press* has published something about it, please let me have the reference."

On referring this inquiry to the Calumet & Hecla Mining Co., which, of course, mines large bodies of native copper, we were informed by H. C. Kenny that the company never had occasion to determine native copper in the presence of chalcocite. Mr. Kenny kindly makes the suggestion that it would not be difficult if no oxidized copper were present. He advises that a solution of cupric ammonia carbonate with an excess of ammonium carbonate should dissolve native copper readily. Coarse metallics should be removed by grinding to fine mesh before this treatment. Mr. Kenny further states that as it might be rather difficult to prepare a solution of cupric ammonia carbonate, a solution of copper sulphate, ammonia sulphate, and aqua ammonia would probably have the same effect, although his company has never used it.

Uses, Properties, and Occurrence of Tantalum

"I am writing you for some information. Will you please be so kind as to tell me where I can get reliable information in regard to tantalum, covering the following points: Where is it mined, what are its properties, who are the big users, and in what form is it generally marketed?"

In the United States tantalum is chiefly found in the mineral columbite, which occurs in the Black Hills of South Dakota. Columbite is a niobate and tantalate of iron and manganese. Tantalum-bearing ores are also imported into the United States, principally from Australia. The metal itself is marketed as wire, sheets, rods, and various other forms.

New uses of tantalum seem to be constantly developed. It is now being used in radio tubes. The Fansteel Products Co. has the following interesting remarks to make concerning the properties and uses of the metal:

"Tantalum of a purity of not less than 99.8 per cent has a steel-blue color when unpolished and a nearly platinum white color when polished. The steel-blue color of the unpolished metal is probably due to a thin film of oxide on the surface. Tantalum has a melting point of about 2,850 deg. C. Tungsten is the only metal which has a higher melting point. The specific gravity of the worked metal is 16.6.

"The metal is characterized by toughness and by great ductility and malleability, and may be submitted to the various mechanical working operations ordinarily applied to the more common metals. The tensile strength of the drawn wire may reach 130,000 lb. per square inch. The linear coefficient of expansion is more than that of molybdenum or tungsten and only slightly less than that of platinum. It has been found possible to seal this metal into glass. The electrical resistance is quite high, being about eight times that of copper and about three times that of tungsten.

"Of all metals tantalum is one of the most resistant to wet chemical corrosion, and in this respect it is the equal of platinum or gold. It is, however, subject to oxidation when heated in the air, the surface becoming blue at a temperature of about 400 deg. C. and nearly black at a somewhat higher temperature. If heated to a higher temperature the metal gradually burns to a white oxide.

"Tantalum also combines at elevated temperatures with hydrogen or nitrogen. It will absorb 740 times its own volume of hydrogen, producing a definite compound known as tantalum hydride, which is a course-grained brittle product. Though pure tantalum is soft and ductile, it becomes harder when it has absorbed gases, and may become brittle if the quantity of absorbed gas becomes too great.

"Tantalum burns when heated in chlorine gas, producing the volatile pentachloride. Aqueous solutions containing chlorine, however, have no action on the metal. Tests made with sheets of tantalum in which the sheets were immersed either wholly or partly exposed to the air in the following reagents showed no gain or loss in weight at the end of fifty days:

Concentrated sulphuric acid
Dilute sulphuric acid
Concentrated hydrochloric acid
Dilute hydrochloric acid
Aqua Regia
Glacial acetic acid
10% acetic acid
50% formic acid
12% formic acid
10% oxalic acid
85% phospharic acid
10% phosphoric acid
5% carbolic acid
15% tannic acid
20% sodium acetate solution
10% iodine solution
Citric acid solution
10% potassium hydroxide solution

"In a similar test in which the sheet was immersed in 33 per cent potassium hydroxide solution for 120 days, the metal showed a discoloration, but there was practically no change in weight.

"The only chemical reagent so far examined which at ordinary temperatures attacks this metal appreciably is dydrofluoric acid, but when both the metal and acid are pure, this action is very slow. A mixture of hydrofluoric and nitric acid will attack the metal rapidly, causing it to go into solution as tantalum fluoride. In the case of high boiling point acids or solutions a slight action may develop at the boiling point; for instance, concentrated sulphuric acid appears to attack the metal very slowly at its boiling point. The same would apply in the case of other concentrated solutions of the caustic alkalies at the boiling points of these solutions.

"The following résumé includes uses to which the metal has already been put and uses which its peculiar properties might suggest. In considering the applications to which this metal is adapted the main points to be considered are its high melting point, its resistance to chemical corrosion, its tendency to absorb gases when heated, and the fact that it oxidizes when heated in air to a red heat. Among the uses for tantalum may be mentioned the following:

Dental instruments and dental spatulas
Surgical tools
Pen points
Filament wire for incandescent lamps or thermionic tubes
Plates and support wires for thermionic tubes
Hypodermic needles
Cathodes for use in electrochemical analysis
Analytical weights, laboratory dishes, spatulas, stirrers and other devices in which a perfectly acid-proof metal would be more suitable than porcelain or glass
Parts of scientific instruments
Acid-proof pumps and parts of commercial chemical equipment
Electrolytic valves for the manufacture of rectifiers for obtaining direct current from alternating current course, as in battery chargers, electrolysis apparatus and radio

Recent Technical Publications

Reviews, Abstracts, and References

Improving the Flotation of a Complex Gold-Copper Ore

A paper of 21 pages in the *Bulletin* of the Institution of Mining and Metallurgy (Cleveland House, 225, City Road, London, E. C. 1; price 1 s.) is entitled "The Concentration of Gold-Copper Ores by Froth Flotation at Tul Mi Chung, The Seoul Mining Company, Korea." The minerals in the ore include pyrite, magnetite, specularite, mispickel, lollingite, and other ores of copper, gold, bismuth, silver, molybdenum, iron, arsenic, zinc, and lead; the gangue comprises garnet in large amount, diopside, serpentine, calcite, epidote, zoisite, actinolite, and pale-green mica. The author of the paper, R. J. Lemmon, was a Minerals Separation representative sent to the plant to improve the unsatisfactory conditions that had obtained, and he has written an excellent report on how the practice was improved and giving the present flow sheet, costs, and pertinent data.

Extremely fine grinding is necessary, accomplished in Hardinge ball and pebble mills in closed circuit with Dorr classifiers. The recovery of all slimed pyrite is essential to secure a satisfactory saving of the gold. To increase the efficiency of the flotation plant, the two M. S. standard flotation machines are now modified as follows: the connecting pipes of the older units are tapped to receive 1-in. pipes, through which compressed air is injected into the pulp flow, so that the aërated pulp, which passes into the bottom of the agitating compartment, beneath the impeller, is subject to the shearing action of the latter, with the production of a cloud of minute air bubbles. The pulp then passes, by the discharge ports, into the frothing boxes. The customary vortex in a standard agitation compartment is destroyed, by means of a horizontal grid, placed well above the impeller, with the result that a mineralized froth forms in the quiescent liquor zone above the grid. The back of each of the agitating compartments is cut down to the level of the froth overflow of the frothing box (or "spitz"), so that by fitting a deflecting board the concentrate overflow is passed to the launder. Thus the whole of the liquor-surface area of the machine, including that of the agitation compartments as well as the frothing box, forms a continuous frothing area. With the diagonal flow normal to the agitation and spitz compartment arrangement, the extended flotation area so provided practically doubles the froth-separation factor, and permits the efficient treatment of a correspondingly increased volume of ore pulp.

A point in this modified design is that the discharge height of the tailing flow automatically controls the pulp level throughout, owing to the slots cut in the side partitions of the agitating compartments; the individual regulation of intermediate compartments, by rod valves, is necessary only when choking occurs, owing to the entry of such foreign substances as wood splinters and waste.

Since no additional power consumption is involved in these modifications, a saving in power, approaching 50 per cent, was effected, owing to the efficient plant capacity being approximately doubled.

The Reagents Used

Several reagents are employed to meet the complex mineralization of the pulp circuit. Thus for "gangue modifiers," sodium hydrate is necessary to counteract the effect of oxidized pyritic slime broken from certain stopes, and is also useful as a coagulant for suspensoid matter; sodium carbonate is of use in preventing calcite from entering the froth in undue quantity; sodium sulphide is employed with the object of slightly coating oxidized pyritic slime particles with a film of metallic sulphide; finally, sodium silicate is added in the re-cleaner unit to wet more effectively any gangue particles entrained in the froth derived from the primary unit.

The oiling and frothing agents are eucalyptus (amygd) oil with a small addition of crude paraffin to act as extra oiler, or froth stabilizer.

The eucalyptus oil, sodium hydrate, and sodium carbonate are all added to the Hardinge ball-mill feed, the sodium sulphide to the primary flotation unit, the paraffin in the ball-mill re-grinder, and the sodium silicate to the feed of the modified re-cleaner unit; the selection of these points for reagent additions is specific and its advantages are confirmed by practice.

The quantities and cost, per ton milled, used in the current froth-flotation practice are as follows:

	Cost at Mine in Pence
Caustic soda, 1 lb. per ton of ore	2.75
Sodium carbonate, 1 lb. per ton of ore	1.00
Sodium sulphide, ½ lb. per ton of ore	1.00
Sodium silicate, 1 lb. per ton of ore	2.00
Eucalyptus oil, 0.3 lb. per ton of ore	5.00
Crude paraffin, 0.25 lb. per ton of ore	0.025
Total cost per ton of ore milled	11.775

The sole method of concentration and recovery now employed at Tul Mi Chung is froth flotation.

The ore milled averages 1.2 per cent copper, which is concentrated to a product carrying about 25 per cent copper, with a recovery of 92 per cent. The following is a typical analysis of the froth concentrate: copper, 25.15 per cent; iron, 32.50; sulphur, 32.80; arsenic, 0.45; antimony, 0.12; lead, 0.65; zinc 0.70; bismuth, 0.18; "insolubles," 7.30; gold, 5 oz. per ton; and silver, 6 oz. per ton.

Electrical Equipment in Mines—The fundamental rule for electrical installations in and about mines is "Never allow any temporary work to be done. Always consider that the installation is likely to be permanent and insist that it be made in a workmanlike manner." This is according to F. C. Stanford, who gives other good advice in "Safety in Electrical Installations in Mines," a 7-page paper recently published by the Lake Superior Mining Institute and obtainable from the secretary, A. J. Yungbluth, Ishpeming, Mich.

British Mining Engineers—The Institution of Mining and Metallurgy, Cleveland House, 225, City Road, London, E. C. 1, England, has just issued its annual membership list. There are about 800 members, 1,050 associates, and 400 student members, a total of about 2,250.

Anaconda Phosphate—The phosphate mines and mill of the Anaconda Copper Mining Co. at Conda, Idaho, are described in a 6-page article in *The Anode* for September (Butte, Mont.)

Lead Refining — The American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York City, has published a paper of 4 pages on "Calculating the Zinc for Desilverizing Lead Bullion by the Parkes Process."

New Patents

Ore Roasting—No. 1,463,867. Aug. 7, 1923. F. G. Breyer, J. P. Hubbell, and D. M. Kerr, Palmerton, Pa., assignors to The New Jersey Zinc Co., New York City. Finely divided zinc sulphide ore is agglomerated into lumps of substantial size, and subjected to a desulphurizing environment, which is maintained by passing through the agglomerated ore a combustion-supporting gas at least a portion of which is preheated.

No. 1,463,901. Aug. 7, 1923. W. L. Maxson, Palmerton, Pa., assignor to The New Jersey Zinc Co., New York City. Zinc sulphide ore is sintered largely by the heat obtained from burning the contained sulphur, and the sintered ore then subjected to a roasting operation to remove the remainder of the sulphur to the desired extent.

Amalgamating Mill—No. 1,464,293. Aug. 7, 1923. D. L. Penrod, Hooper, Utah. A frame containing superposed inclined trays on which ores are subjected to amalgamation, the residue being carried to the head of the machine by a bucket elevator.

Oil-Well Casing—No. 1,464,350. Aug. 7, 1923. H. C. Cable, Los Angeles, Calif., assignor to M. L. Sweeney and E. J. Bowen, of Los Angeles. A casing made up of two walls which are interlocked by a series of annular ribs, and also fastened together with rivets. The casing is of sufficiently uniform diameter for a sufficient distance between the ribs to allow space for the attachment of an elevator.

SOCIETIES, ADDRESSES, AND REPORTS

Engineering Societies to Investigate College Courses

Will Initiate Movement to Prepare the Engineers of the Coming Generation for Most Effective Service to Their Country and the World

THE CARNEGIE CORPORATION voted at a meeting held in New York Oct. 30 to assist with upward of $100,000 a movement to better engineering education, which is being fostered by the Society for the Promotion of Engineering Education and the National Industrial Conference Board. It is believed that the cost of the inquiry will amount to $24,000 the first year, $36,000 the second year, and $48,000 the third year. The society is approaching the subject from an educational point of view and the board from the standpoint of the man in industry who employs engineers and that of practicing engineers themselves.

The Society for the Promotion of Engineering Education proposes during the next three years to make a discriminating study of the present state of engineering education. It is accepted as a fact that the engineer of tomorrow will be called upon to take even a more important part than the engineer of today in great enterprises, both private and public. It is believed he will be called upon for general service in organization and leadership as well as for technical service in the solution of new problems (industrial, economic, governmental and social) which the engineering applications of science have produced. This, it is held, means imagination, vision, the power to conceive and the ability to carry out great projects. To develop, broaden, and enrich engineering education is the object of the proposed inquiry.

The active conduct of the study will be under the supervision of a director, with headquarters in New York. He will be appointed by a board of investigation and co-ordination named by Charles F. Scott, for two years president of the Society for the Promotion of Engineering Education. Mr. Scott is chairman of the board. The director will organize committees in the faculties of as large a number of engineering schools as may be practicable to assist in the prosecution of the inquiry.

The members of the board of investigation and co-ordination are: Charles F. Scott, president of the Society for the Promotion of Engineering Education and head of the electrical engineering school at Yale; M. E. Cooley, dean of the engineering department at the University of Michigan; D. C. Jackson, professor of electrical engineering at the Massachusetts Institute of Technology: Dr. F. W. McNair, president of the Michigan College of Mines at Houghton, Mich.; and J. H. Dunlap, secretary of the American Society of Civil Engineers.

President Scott has been authorized to invite on behalf of the society the American Society of Civil Engineering, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the organizations of mining engineers as a group, each to appoint two councilors to represent the societies and serve in an advisory capacity to the board of investigation and co-ordination. The societies have consented to this and appointments will soon be announced. As a result, these eight men will meet from time to time with the board in consultation.

There will be represented in the inquiry all people interested in engineering education and, in conjunction with the investigation now under way by the National Industrial Conference Board, every point of view. Accordingly, it is believed some significant results will be achieved as a result of the proposed study.

The investigation will be directed to a study of the objects of engineering education and the fitness of the present-day curriculum for preparing the student for his profession. It will study the process by which the curriculum of fifty years ago has come to its present form; it will seek to set forth the nature and weakness of the curriculum as at present administered; and it will indicate such modifications or developments as would seem to make for a sound and well-balanced course of study for engineering students.

Inasmuch as a study of the engineering curriculum of American schools should include a knowledge of, and comparison with, the best schools in Europe, the director of the work will visit such engineering schools of European countries as may throw light upon the best methods in engineering education.

It is held that the problem of engineering education is to determine and to meet the progressive demands of a rapidly changing civilization. What constitutes these demands is a question being considered by educators, by engineering societies, by organizations of industries and public utilities and by others. Unfortunately, there has been almost no co-ordination of effort, and there is lack of agreement on even fundamental objectives. These deficiencies it is now proposed to correct.

E. C. Church Addresses New York Section of the A.I.M.E.

A disappointingly small assemblage heard E. C. Church, chief engineer of the Port Authority, address the Metropolitan Section of the A.I.M.E. at the Chemists' Club on Oct. 24. Mr. Church spoke entertainingly on the traffic problems in and around the city. He showed by means of a picture film why potatoes cost more than they ought.

Oddie and Lawrie to Address Mining and Metallurgical Society

Senator Tasker L. Oddie, of Nevada, chairman of the Senate Commission of Gold and Silver Inquiry, and H. N. Lawrie, the economist of the commission, have accepted invitations to address the Mining and Metallurgical Society of America on Nov. 21, at the Harvard Club, in New York City. On that occasion Senator Oddie expects to present a draft of his bill providing for the establishment of a Department of Mines. Senator Oddie hopes to secure suggestions and criticisms from the industry and from government departments so that the measure will meet general support when it is introduced. Mr. Lawrie will review the activities of the commission on behalf of the American silver-producing industry.

Memorial Services Held for Henry Marion Howe

Industrialists, engineers, and educators attended the memorial service to the late Dr. Henry Marion Howe at the Cathedral of St. John the Divine, New York City, on Oct. 25. A delegation from the Iron and Steel Committee of the American Iron and Steel Institute, and members of the Board of Directors of the American Institute of Mining and Metallurgical Engineers, of which Dr. Howe was a past president, were present. Others in the congregation were Dean George B. Pegram and the faculty of the Schools of Mines, Engineering and Chemistry of Columbia University.

MEN YOU SHOULD KNOW ABOUT

Karl Eilers has returned to New York from a three weeks' trip to Colorado and Utah.

John Eoghan Kelly, of New York, is visiting oil fields in Oklahoma, Arkansas, and Texas.

Louis P. Collin has been appointed ceramic engineer of the Mines Branch of the Canadian Department of Mines.

J. M. Schloss, a mining engineer of New York, has arrived in Portuguese West Africa, where he is engaged in oil explorations.

Walter Douglas left New York on Friday, Oct. 26, for a month's visit to some of the Phelps Dodge properties in the Southwest.

Frank C. Loring, mining engineer, of Toronto, Canada, recently completed an examination of the Billy Goat mine, in Okanogan County, Wash.

Frank G. Stevens recently visited the Herb Lake district, in northern Manitoba, and is now at the West Dome Lake mine, at Porcupine.

P. R. Bradley, general superintendent of the Alaska Juneau, will be in San Francisco early in November and will remain over the holidays.

Henry Gregory has been appointed general manager of the Lampa Mining Co., Ltd., a silver and copper mining company in southern Peru.

D. A. Lyon and **F. B. Tough**, of the U. S. Bureau of Mines, are in San Francisco on a tour of inspection of the field service of the Bureau.

R. D. Leisk, of Venado, Calif., is now at Gallup, N. M., in charge of operations of the Mutual Coal, Light & Power Co., a subsidiary of the United Verde Extension Mining Co.

Spencer Hutchinson and **Robert Livermore** announce that they have formed a partnership as mining and consulting engineers, with offices at 201 Devonshire St., Boston, Mass.

Morton Webber was recently at Nacozari, Mexico, on a visit of inspection of the Diesel-Saltzer power plant of the Las Chispas mine, for which property he is consulting engineer.

R. C. Tucker, of the staff of the West Virginia Geological Survey, has prepared a structural map of Ohio, Brooke, and Hancock Counties, W. Va., which should be published by the end of the year.

Earle D. Moiles has resigned as mechanical engineer for the United Comstock Mines Co. and has accepted a position as sales engineer for the Bodinson Manufacturing Co., of San Francisco.

J. Benjamin Parker, metallurgist and inventor of the Parker flotation machine, has returned to the Coeur d'Alene mining district of northern Idaho after a six weeks' sojourn in Salt Lake City.

Prof. E. S. Perry, former department head of geology at the University of Kentucky, has accepted the position as head of the geological department of the New Mexico School of Mines at Socorro, N. M.

L. M. Warner has recently been promoted to the office of superintendent of the Herculaneum smelter of the St. Joseph Lead Co., at Herculaneum, Mo. **C. W. Badgley** has been appointed assistant superintendent.

George K. Burgess, director of the Bureau of Standards, has been elected president of the American Society for Steel Treating to succeed A. B. Lynch, of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.

W. N. Logan, State Geologist of Indiana, with the co-operation of the members of the department of geology of Indiana University, working with the

W. N. Logan

division of geology of the Conservation Department of Indiana, has under present supervision the preparation and issue of a large number of reports on the geology and oil, gas, and coal resources of the state.

Oscar Hershey, geologist for the Bunker Hill & Sullivan Mining & Concentrating Co., and the Davis-Daly interests of Butte, recently has been employed in investigating British Columbia properties and mines near Bossburg, Wash.

Prof. J. C. McLennan, head of the department of physics at the University of Toronto, who recently came into prominence by his discoveries concerning the liquefaction of helium, has declined an offer to become vice-chancellor and president of Queen's College, Belfast, Ireland.

Albert H. Fay, mining engineer, has resigned from the government service and will go into practice as a consulting engineer, with offices in the Insurance Building, 907 15th St., Washington, D. C. Mr. Fay was formerly on the staff of *Engineering and Mining Journal*

Arthur J. Bensusan, manager of a British-owned gold mine at Passagem, Minas Geraes, Brazil, is in New York on his way to Brazil from London, after a trip through the Ontario and Lake Superior mining districts. The Passagem mine is producing as a byproduct, about twenty tons of white arsenic a month, which is sold in the London and New York markets.

Edwin Higgins, **J. A. Fulton** and **Elmer E. Paxton** were elected members of the board of directors of the California Metal and Mineral Producers' Association at a meeting held in San Francisco on Oct. 25, 1923. Mr. Paxton was elected president of the association; **Mr. Fulton**, first vice-president; **P. C. Knapp**, second vice-president; **E. C. Hutchinson**, third vice-president, and **Robert I. Kerr**, secretary-treasurer.

Paul S. Black, who has been serving the War Minerals Relief Commissioner in a legal capacity, has been recalled to the service of the Bureau of Mines to undertake a study of state and federal coal mining codes and workmen's compensation acts and laws dealing with safety in mining. This work is being undertaken in an effort to carry out one of the recommendations of the Harding Coal Commission. **Dean Holbrook**, Pennsylvania State College, will co-operate with Mr. Black in this work.

R. E. Collom has resigned from the position of State Oil and Gas Supervisor of California. With the exception of an interval of one year and a half as petroleum technologist for the U. S. Bureau of Mines, Mr. Collom has been identified with the work of the Department of Petroleum and Gas, California State Mining Bureau, in various capacities since 1915—the year of its inception. He has been State Oil and Gas Supervisor since January, 1921. He will open an office in San Francisco as a consulting petroleum engineer.

Charles P. Tolman, of New York, has resigned as chief engineer and chairman of the manufacturing committee of the National Lead Co., a position which he had held for sixteen years, and has gone into general consulting practice with offices at 111 Broadway, New York City. He will continue as consulting engineer for the National Lead Co., and will specialize in dust and fume control, handling materials and products and in manufacturing methods and processes. Mr. Tolman is a former president of the National Safety Council.

OBITUARY

J. E. Stead died at Redcar, Yorkshire, England on Oct. 31. Mr. Stead was a brother of the noted journalist, W. T. Stead. He was the acknowledged British authority on the manufacture and metallurgy of steel, and famous as a metallurgical chemist. He was the recipient of numerous scientific degrees and for a time president of the Iron and Steel Institute. Mr. Stead was born in 1851.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary of the Week

WAGE REDUCTIONS averaging 50c. per shift, starting at Butte, Mont., and Bingham, Utah, have spread to all the Arizona copper camps and to Ely, Nev., and Santa Rita, N. M. Quincy is the only company thus far to announce a cut in Michigan.

Production of zinc ore in the Joplin-Miami district has been suspended by two-thirds of the active mines for the week beginning Nov. 5. Shipments during the last week of October exceeded 19,000,000 lb.

A meeting of the organization committee for the Silver Export Association has been called for Nov. 15 in New York.

The Treece (Kansas) section of the Joplin-Miami district is the scene of increased activity.

The Gold Hunter company has resumed production in the Coeur d'Alene district, in Idaho.

Ahmeek, in Michigan, established a new record for copper production during October.

The A. S. & R. Co. has optioned the Western Utah Copper mine and the company's arsenate plant at Salt Lake City.

The Mason Valley Mines Co. has acquired the adjoining property owned by the Blue Stone Mining & Milling Co.

The output and profits of the Hollinger at Porcupine will be much less for 1923 than for 1922.

The Britannia concentrator on Howe Sound is doing excellent work at 35 per cent above rated capacity. It is making 20 per cent concentrate.

The United Verde Copper Co. has abandoned its tax fight in Arizona and has decided to pay on the original assessed valuation.

A. S. & R. Co. Options Arsenate Plant at Salt Lake City

Western Utah Copper Mine Leased—Will Make Insecticide—May Enlarge Plant

The American Smelting & Refining Co. has taken over the interests of the Salt Lake Insecticide Co., which has been operating a plant in Salt Lake City and producing calcium arsenate from the scorodite ores of the Western Utah Copper at Gold Hill near Wendover, Utah. The smelting company will derive its ore from the same source as the former company, and has taken a long-time lease on the Western Utah Copper property. Present production will be at the rate of fifteen tons of calcium arsenate daily, and the output of the plant will be increased according to the needs of the market. The product is used for the manufacture of insecticide, largely consumed in combating the boll weevil. The demand for the material is growing steadily. During the 1923 growing season makers of insecticide consumed more than 32,000,000 lb. of calcium arsenate. The A. S. & R. Co. is the largest producer of arsenic trioxide in the country, as a byproduct in its smelting operations. The latter, however, is not so convenient for the manufacture of insecticides as calcium arsenate.

The Salt Lake plant has not been a complete success under its former management, and it is the purpose of the smelting company to operate it for six months as an experiment, with the probability of purchase at the end of that time should the temporary operation be successful.

It is argued that the market for the insecticide, which has fluctuated wildly during the last two years, would be greatly benefited by the entrance of a powerful company. There are about twenty-five producers of calcium arsenate in the country at present. Many of them are small factors. The large producers have always competed keenly for business. In addition, there has been a tone of suspicion in their dealings with competitors, which has naturally not assisted in securing a steady market for calcium arsenate. The new producer, it is believed in the trade, will be able to set the pace on production, sales and prices. Such a development will go a long way toward assuring the planter of an adequate supply of poison at prices not greatly at variance with the costs of production.

Falcon Mines Produced £24,360 in September

September operations at the Bulawayo mines of the Falcon Mines, Ltd., in Rhodesia, show 16,662 tons of ore milled, producing 233 tons of blister copper, containing 2,379 oz. of gold and 4,819 oz. of silver. Figuring copper at £56 per ton, the estimated value of the output is £24,360.

Ahmeek Establishes New Copper-Production Record

Rock Averages 35 lb. per Ton—Big Factor in Keeping C. & H. Con. Costs Down

Ahmeek, an important unit in the Calumet & Hecla Consolidated, in the Michigan copper country, has enlarged its underground force, and is now producing at the rate of approximately 2,300,000 lb. of refined copper monthly, a new record for the property, exceeding even the war-time peak. Ahmeek rock is averaging better than 35 lb. to the ton. Mass copper from the fissure vein in No. 2 shaft, which is being sent direct to the smelter and smelted at intervals, does not enter into the monthly production figures given.

Calumet & Hecla Consolidated is particularly fortunate in these days of low-priced copper in being able to produce metal at comparatively low cost so far as the Michigan district is concerned. Ahmeek is a low-cost producer, due to the high average content of its rock, and the Calumet & Hecla conglomerate sands, which are being reworked, is another source of low cost copper. Calumet & Hecla rock in the upper levels of the conglomerate deparment also runs high in copper values. Under the circumstances, Calumet & Hecla should be able to weather the present period of depression in the industry to probably better advantage than other Lake Superior mines.

St. Joe and Henry Ford Dominate Southeast Missouri Lead Belt

St. Joe Big Producer—Ford Prospecting 10,000 Acres Under Option —Apprehension Over Latter's Labor Policy—Many Drills Will Be Needed for Comprehensive Search

By Our Special Correspondent.

THE "disseminated" lead district of southeast Missouri is much excited by the recent absorption of the Federal Lead Co. by the St. Joe Lead Co., for a consideration of $10,000,000, of which $5,000,000 is cash and the balance in five annual payments of $1,000,000 each at 6 per cent interest. As it was not many years ago since the Federal Lead Co. attempted to secure control of the St. Joe Lead Co., the district is much surprised at this sudden change in conditions. This acquisition of about 15,000 acres of land that has one 4,000- and one 6,000-ton mill and eleven shafts makes the St. Joe Lead Co. emphatically the preponderating influence in the "Lead Belt," as there now remain only two other large producers, the National Lead and the Desloge Lead companies. The only other producing company—and it is yet on a small scale—is the Annapolis Lead Co., in Iron County.

As the St. Joe company is changing haulage from all its shafts to its present three mills from surface to underground, this absorption of the Federal Lead property will help greatly. The two properties checker-boarded each other and interfered with such a plan heretofore. The St. Joe company will have a better opportunity for controlling the labor situation, as it will employ over 75 per cent of the workers in the district. This latter feature may prove important, in view of the possible entrance of Henry Ford in the district; he is expected to pursue his usual policy of paying high wages.

The St. Joe company has already taken over the operation of the Federal properties and has placed its own men in all the important executive positions. As C. J. Adami, manager for the St. Joe company, was in charge for the Federal company in this district before he took charge of the St. Joe operations, he is already familiar with the local details of the Federal mines and mills.

The Henry Ford interests are now established in the district, have opened an office at Bonne Terre, and have started diamond drilling on the 10,000 acres they have under option in St. Francois and Washington counties. Two drills are now in operation and several more have been ordered. A corps of experts is on the ground to look after the drilling. Unless they put in 50 to 100 drills, they can at best attain only a very superficial knowledge of the one hundred or more tracts that are under option for from six to twenty-four months, as experience has shown that, unless the drilling is thoroughly done with closely spaced holes, results are likely to be misleading. However, Ford is fortunate in starting drilling at this season of the year when the fifty or more drills usually operated by the present companies are generally idle for the winter. There is an abundance of experienced drillers.

Prominent engineers who are well acquainted with the district are satisfied that Ford can build up a large production from the properties that he now has under option if he prospects thoroughly, notwithstanding that most of the tracts have been drilled at one time or another by present interests.

The records of the district have shown in many instances that "condemned" lands that have been drilled once have later proved valuable producers when redrilled by other operators. In fact, until recently, land owners were not only refused a record of the drill results, but were not even allowed to be at the drills while the prospecting was going on, so that it was easy for the operators to report adversely.

The absorption of the Federal Lead Co. recalls the history of the last twenty years in the district. The Federal Lead absorbed the Irondale, Derby, Central, and Leadington companies. The Doe Run company absorbed the Columbia and Donnelly companies, and the Doe Run was then absorbed by the St. Joe company. The St. Joe company absorbed the Baker and Big River Lead companies and the National company absorbed the Taylor company.

New Oreshoot Reported in Indian Mine, Portland Canal

The Indian Mines Corporation is said to have struck a second oreshoot, 810 ft. from the portal of No. 1 adit, on its property 1¼ miles northwest of the Premier No. 4 camp in the Portland Canal district of British Columbia. The vein is 24 ft. wide at this point, and the company is driving on both walls. The face of the hanging-wall drift assayed 0.68 oz. in gold and 210 oz. in silver, the ore showing wire and flake silver freely; a two-foot streak in the footwall drift assayed 2.72 oz. in gold and 7.9 oz. in silver per ton and 17.4 per cent of lead.

The company purposes to connect the two drifts by a crosscut, from the center of which a raise will be put up to the surface, 260 ft. From this point only one drift will be continued, the other being used as a haulage way. By this method the raise will not impede the horizontal exploration of the vein. A drill hole 250 ft. ahead of the present face indicated a width of 50 ft. of well-mineralized ore.

Silver Export Organization Committee Meets in New York, Nov. 15

PLANS for the organization of the proposed Silver Export Association will be formed at a meeting in New York on Nov. 15 of the committee appointed as a result of the Reno conference. Fifteen companies operating in the United States, Canada, Mexico and South America are represented. The meeting will be held in the Waldorf-Astoria. Cornelius F. Kelly, president of the Anaconda Mining Co., is chairman of the committee.

Utah Smelting Companies Cut Wages 7½ Per Cent

The smelting companies operating in Salt Lake Valley in Utah have joined the copper-mining companies in cutting wages. The reduction amounts to 7½ per cent, or about 50c. a day. At the Utah Copper properties, common labor is reduced 40c. a day, and skilled labor, 50c. Other companies making reductions are Utah Consolidated, Utah-Apex, United States Mining, and Bingham Mines, all at Bingham. The smelting companies include the American Smelting & Refining Co., the United States Smelting & Mining Co., and the International Smelting Co.

Arizona Copper-Mining Companies Announce Wage Cut

Effective Nov. 1, the copper-mining companies of the Arizona reduced the pay of all employees approximately 9 per cent, amounting to a return to the former wage scale of last March. Under the new schedule of rates miners will receive $4.95; muckers, $4.40; and mechanics, $5.23. This announcement came following a conference of mine managers at Phoenix on Oct. 26, which was attended by representatives of eight of the larger companies. It is admitted that the supply of skilled miners in the Arizona districts is far from being ample, many sections experiencing an actual shortage, but it is said that either a lowering of operating costs or a shutdown is inevitable for many producers, because of the low selling price of copper. The shortage of men has been particularly noticeable among the plants where considerable construction is under way, as it is difficult to get mechanics and skilled men to carry on the work.

Hollinger Finances Mines Scholarship at Toronto

The board of governors of Toronto University has accepted the scholarship, valued at $1,200 annually, offered by Hollinger Consolidated Gold Mines, Ltd., for research work by university graduates, under the direction of Prof. H. E. T. Haltain, in the department of mining engineering.

Tonopah Has Narrow Escape from Serious Fire

A fire occurred at Tonopah, Nev., at 3 a.m. on Oct. 23, and a blaze that might have wiped out the principal part of the town was finally controlled after burning two buildings and slightly damaging two others. The loss was about $20,000, most of which was covered by insurance. The Western Union Telegraph Co.'s quarters and the Monahan Brokerage were completely destroyed and the Central Market and Mizpah Hotel slightly damaged. The burned buildings are to be replaced by a concrete structure, work on which already has been started.

Week's Zinc Shipments from Joplin-Miami Total 19,640,000 Lb.

Sales Exceeded Production During Last Week of October—Brief Shutdown Planned, Nevertheless

With the zinc concentrate market firm at about $40 per ton, the Tri-state zinc district shipped 19,640,000 lb. during the week ended Oct. 27. Lead to the amount of 2,401,530 lb. also was shipped. Production is considerably less, but stocks are large and a shutdown for the week beginning Nov. 5 is being observed generally.

During the forty-three weeks of the current year 1,099,630,700 lb. of zinc and 147,050,400 lb. of lead concentrate, having a total value of $29,600,281, have been marketed in the district. The accompanying table shows the shippers:

OKLAHOMA MINES

Company	Zinc Concentrate, Lb.	Lead Concentrate, Lb.
Admiralty Zinc Co.	169,400	.....
Anna Beaver M. Co.	415,540	65,716
Bilharz M. Co.	262,730	.....
Black Hawk L. & Z.	150,090	.....
Commonwealth M. Co.	.....	214,530
Cortez M. Co.	211,690	.....
C. G. & K. M. Co.	86,410	.....
Dorothy Bill M. Co.	203,830	.....
Dudley M. Co.	63,500	.....
Eagle-Picher L. Co.	577,480	.....
Federal-Brewster	448,330	.....
Federal-Dobson	385,970	.....
Federal-Farmington	206,780	.....
Golden Rod, M. & S.	2,235,600	219,620
Gordon M. Co.	166,960	.....
High Tail M. Co.	84,540	.....
Huttig L. & Z. Co.	940,930	.....
Howe M. Co.	.....	88,440
H. K. M. Co.	163,940	.....
Incas M. Co.	91,900	.....
Jeff. City M. Co.	85,370	.....
Jack and Jill M. Co.	80,690	.....
Laclede M. Co.	108,540	.....
La Salle M. Co.	485,550	.....
Lion M. Co.	259,190	.....
Lucky Kid M. Co.	249,760	.....
Lucky O. K. No. 2	84,900	.....
Manhattan M. Co.	420,410	.....
Moore M. & S. Co.	146,060	.....
Meteor M. Co.	104,720	.....
Montezuma M. Co.	218,260	.....
New Chicago M. Co.	85,900	.....
New York M. Co.	86,690	.....
Oko M. Co.	284,380	.....
Quapaw-Tom L.	178,270	93,820
Rialto M. Co.	280,000	83,260
Royal M. Co.	67,680	.....
Santa Fe M. Co.	483,560	.....
St. Louis S. & R. Co.	1,810,960	.....
Skelton L. & Z. Co.	341,560	.....
S. R. & W. M. Co.	172,020	.....
Underwriters' Land	320,620	.....
Vantage M. Co.	260,310	.....
Vinegar Hill Texas M.	435,120	85,560
Vinegar Hill Wilson	65,260	.....
Woodchuck M. Co.	647,920	.....
Sundries	504,720	1,215,800
Totals	15,222,480	1,978,290

Values: Zinc, $304,440; lead, $79,120. Total, $383,560.

KANSAS MINES

	Zinc	Lead
Bendelari M. Co.	87,910	.....
Blue Diamond M. Co.	84,510	.....
Chanute Spelter Co.	438,830	.....
Empire Dev. Co.	4,170	.....
Fed.-Kansouri Mine	331,230	.....
Homestake M. Co.	434,440	.....
Lucky Jew M. Co.	.....	149,050
Muncie M. Co.	61,360	.....
Queen Esther M. Co.	172,200	.....
Quapaw-Chubb M. Co.	556,090	.....
Redskin M. Co.	171,020	.....
Silver Fox M. Co.	172,830	.....
Southern L.-Z. Co.	197,120	.....
Vinegar Hill Barr	131,000	.....
Sundries	.....	274,190
Totals	2,842,210	423,240

Value—Zinc, $56,840; lead, $16,880. Total, $73,720.

MISSOURI MINES

	Zinc
American Z., L. and S. Co.	375,620
Allegheny Western M. Co.	26,790
Barnsdall Zinc Corp.	636,670
Butte-Kansas M. Co.	248,550
Pyramid M. Co.	34,580
Tulsa-Pittsburg M. Co.	253,410
Total	1,575,620

Value, $31,480.

TOTAL PRODUCTION

Zinc, 19,640,310 lb. value $392,760. Lead, 2,401,530 lb.; value $96,000. Total value, $488,760. Average value per ton—Zinc, $40; lead, $80.

Dispute Ownership of $10,000 Silver Nugget

Fraud Alleged in Connection With Rich Find at Gillies Limit, Near Cobalt, In Northern Ontario

C. W. Price, of Cobalt, has brought an action against Anson Clements, of the same place, claiming ownership of the 2,500-lb. silver nugget recently removed by Clements from mining claim No. 19,943, in the Gillies Limit. The nugget is stated to be worth $10,000, and the plaintiff asks damages. An injunction was granted restraining Clement from disposing of the nugget until the action comes up for trial on Nov. 8.

An affidavit by Price states that he staked the limit in question on June 17, 1923, and on Sept. 24 gave an option to the defendant. He alleges misrepresentation, and that Clements, when he obtained the option, knew of the existence of the nugget. It is further alleged that since the option was given the boundary posts of the claim have been moved to make it appear that the nugget came from an adjoining claim owned by Clements.

Foley Mine, in Ontario, Will Be Developed

The British Canadian Mines, Ltd., has cleared up the title to the Foley mine, at Mine Center, in the Fort Francis mining division in Ontario, and plans to develop the property. Present equipment includes a 20-stamp mill, a 12-drill compressor, and necessary boilers and engines. Of the three shafts on the property the deepest is 420 ft. When formerly operated $15.82 per ton was recovered by amalgamation, the recovery being only 60 per cent. Frank Carnegie, who is in charge of the property, estimates 40,000 tons of proved ore and 400,000 tons of partly developed ore averaging $12.50 per ton.

Americans Get Rights to Prospect Siberian Placer Ground

Prospecting rights in approximately 3,500 square miles of placer gold fields in the Amur region in Siberia have been conceded to the Far East Exploration Co., headed by Henry T. Hunt, of Cincinnati, according to cable dispatches from Moscow. The concession was obtained by Charles H. Smith, former American member of the Chinese Eastern Railway Commission. Mr. Smith is now in Moscow.

The company expects to begin work in the spring, but its rights are held until Jan. 1, 1925, after which date it must make a final contract.

Britannia Mill Does Good Work with Production 35 Per Cent Above Capacity

Concentrate Averages 20 Per Cent Copper—Attributed to Improved Ore Dressing—Earns Dividends

For the last two months, the Britannia Mining & Smelting Co.'s new mill on Howe Sound, British Columbia, has been treating on an average 2,700 tons daily, which is 35 per cent more ore than the mill was designed to handle. Britannia ore, like most of the British Columbia copper ores, carries a large proportion of pyrrhotite and pyrite as well as sulphides of copper, and there is considerable difficulty in separating the sulphides of the two metals. In the old mill a 14 per cent copper concentrate was considered good. During the last two months Britannia concentrate has been running in the vicinity of 20 per cent copper. The improvement in grade is attributed to improvement in milling practice, rather than any change in the ore. The fact that Howe Sound Co., Britannia's holding company, resumed the payment of dividends about three months after the Britannia mill had been started would seem to indicate that Britannia is one of the few concerns that is making a profit from the mining of copper ore.

United Verde Abandons Tax Fight; Will Pay

The United Verde Copper Co., of Jerome, has discontinued its tax suit against the State of Arizona and has expressed a willingness to pay taxes of last year as previously assessed. The action, which was brought by the company nearly a year ago, attacked the valuation placed on its holdings, objecting to the methods used in arriving at the assessed value, and, in a way, instigated a suit that, if successful, would have resulted in changing the entire tax procedure in Arizona. The company paid only a tax based on what it considered fair assessment, and obtained an injunction, restraining the county treasurer from collecting the original amount asked. In discontinuing the suit, the company agrees to pay the taxes in full as based on the valuation as fixed in the first instance by the state commission.

Mason Valley Acquires Bluestone Mine, in Nevada

Gray Eagle, California, Shares Offered to Mason Valley Stockholders —Remodel Smelter

The Mason Valley Mines Co., owning mines and a smelter in Lyon County, Nev., has concluded negotiations with the Bluestone Mining & Milling Co. by which it acquires for 246,268 shares of Mason Valley all properties of the Bluestone company and $160,000 cash in its treasury.

The Bluestone mine is about one mile north of the Mason Valley mine. Ore developed in the Bluestone mine is about double that in the Mason Valley property. The Bluestone is equipped with a mill having a capacity of 700 tons of ore a day, which can be enlarged to treat 1,000 tons a day. This mill is so situated that it can be used to treat ores of milling grade from the Mason Valley mine.

To provide stock to be traded for the Bluestone holdings it is necessary to increase capital stock of the Mason Valley company, which at present consists of 500,000 shares, par $5, issued and outstanding. It is proposed to increase the capital stock to 1,000,000 shares, par $5, which will leave, after the Bluestone negotiations are consummated, 253,732 shares in the treasury. A special meeting to authorize such increase in capital stock has been called for Nov. 19.

In valuing the Mason Valley and the Bluestone properties difficulty was experienced in arriving at agreement as to value of the Gray Eagle mine, in Siskiyou County, Calif., owned by the Gray Eagle Copper Co., all of the capital stock of which is owned by Mason Valley. The Mason Valley company has decided to dispose of this property. It is therefore offering Gray Eagle shares to Mason Valley stockholders at $5 a share.

The Gray Eagle property contains 1,045,000 tons of ore averaging 3.23 per cent copper. The mine is 60 miles from the railroad and is not equipped with mining and milling facilities.

With $160,000 obtained from the Bluestone treasury and the $250,000 from sale of Gray Eagle stock, Mason Valley will have cash and liquid assets of $1,125,000. This will provide sufficient funds to make whatever changes may be necessary in the smelting plant and to enable the company to pursue an aggressive smelting policy.

Treece Zinc District, in Kansas, Has Active Producers

The Eagle-Picher Lead Co., which recently took a lease on a 140-acre tract of Robinson land, northwest of Treece, Kan., is sinking two new shafts and deepening two old shafts, preliminary to active development. One of the new shafts will be sunk to the 350 level, and will be connected at that depth eventually with the workings of the Lucky Jew mine, near by, thus affording ventilation for both properties. The other shaft is being put down about half a mile south of the Lucky Jew.

This part of the field is coming in for considerable new development and promises to contribute much to the production. The Chubb and Cherokee properties, both opened up recently, are excellent mines. The Federal Kansouri is expected to be a heavy producer, and the Tulsa-Quapaw Co. will soon have its new mill in operation in this section.

Hollinger Output and Earnings Much Less Than in 1922

Power Shortage Contributing Cause—Grade of Ore Lower—Reserves $63,000,000 Above 1,250 Level

An analysis of the 1923 operations indicates that the report for the current year of the Hollinger Consolidated Gold Mines Co., of Porcupine, Ont., will show substantial decreases in both gross output and net profits. This, however, is explained by the power shortages, which seriously affected the company's operations. It is estimated for the year the mill will treat 1,200,000 tons and the gross income will be $9,500,000. This compares with 1,491,000 tons and a gross income of $12,825,000 for 1922. The average grade of ore treated for this year is $7.78, compared with $8.83 last year, and this drop in grade is also indirectly due to power shortage, as the proportion of ore from development faces was much greater. There will, however, be a substantial increase in ore reserves, the estimate running from $60,000,000 to $63,000,000, compared with $43,000,000 last year. When it is considered that the properties comprising the Hollinger have produced over $70,000,000, and that the ore reserves lie largely above the 1,250 level, the figures take on an added significance.

The company is now establishing a main development level at 1,700 ft., and the management knows no reason why a much greater depth should not be expected. It is understood that the company contemplates diamond drilling a deep hole from the 1,700 level.

Gold Hunter Resumes in Coeur d'Alene; Idle Three Years

After a suspension covering a period of three years, the Gold Hunter Mining & Smelting Co., of Mullan, Idaho, resumed production on Nov. 1. During the suspension a large number of leasers were engaged in gleaning the old workings, and their aggregate shipments amounted to between 400 and 500 tons per month, the ore being rich in silver. At the same time the company carried out quite an extensive development program, which has resulted in making a large tonnage of lead-silver ore available and which insures steady operation of the 300-ton mill. The company will employ about 160 men.

The Hunter was one of the early discoveries in the Coeur d'Alene district. It has produced for thirty years, and its orebodies are understood to be still far from exhaustion.

Mining Corporation's Cobalt Mines Not Yet Exhausted

South Lorrain Outlook Good — New Flin Flon Claims Staked—Plant Sites Secure

The Mining Corporation of Canada has issued an interim report on the company's various properties. Better results have been encountered in the Cobalt properties, and it now appears that the ore will not be exhausted this year, as was previously expected. Production from the Cobalt properties is estimated at 800,000 oz. for the year.

In South Lorrain the main shaft of the Frontier has been completed to the 6th level, and drifting has been started on the 5th and 6th levels.

The company also owns an interest in the Trout Lake Mines, which owns three claims adjoining the Keeley on the south. These claims were purchased last March, but in view of the heavy expenditures required for the development of other properties, a two-third interest in the property was sold to English interests, which repaid the Mining Corporation more than the cost of the property, and in addition provided $150,000 cash for the treasury. The Mining Corporation, however, retains the management of the Trout Lake property. The company has met with favorable results in the development of this property, and silver taken from the work that has been done has more than paid for the cost of development to date.

Geological work only was carried on in the Flin Flon area, in northern Manitoba, during the last season, and nineteen new claims were staked, which cover possible extensions of the Flin Flon orebodies to the north and south, control desirable sites for mill, smelter, and town and protect the water supply.

Minnesota Agrees to Remit $1,500,000 Mine Tax Penalties

The Minnesota Tax Commission has rendered a decision relative to the controversy over payments under the Occupational Tax Law. It has agreed to set aside all penalties, amounting to approximately $1,800,000, except the 6 per cent interest for the years 1921 and 1922, which will amount to approximately $300,000. The total amount of the tax involved is $6,009,754, of which $2,243,017 is for the year 1921 and $3,466,737 for the year 1922.

The Occupational Tax Law was passed by the Minnesota Legislature in 1921, and soon thereafter the various mining companies attacked the validity of the statute. Recently the U. S. Supreme Court, after long legal proceedings, announced the law constitutional. The companies requested a hearing before the tax commission, and decision above noted has just been rendered. The only provision imposed by the commission in return for this abatement is that the companies pay the full amount within thirty days.

News from Washington

By PAUL WOOTON
Special Correspondent

Technical Research May Be Prime Aid to Silver Producers

Little Done Heretofore to Promote Use—Peculiar Properties Make It Suitable for Many Things—Alloys With Aluminum —Bain Wants Suggestions from Industry

JUDGING from the communications that have reached the Bureau of Mines since the suggestion that technical research be undertaken in an effort to establish new or to increase old uses of silver, there is general support in the silver-mining states for such a project. Though large sums of federal money have been expended on research intended to aid the agricultural or manufacturing industries, it is a fact that little governmental research has been done on silver. It also is pointed out that the industry itself has been particularly lethargic in that particular. The greatest enterprise has been shown in connection with the treatment of silver ores, but comparatively little work has been done in an effort to widen the use of silver.

The letters reaching the Bureau of Mines emphasize the difficulties surrounding the production of silver under existing conditions. As there is no convincing reason for belief that costs of production can be reduced materially, and since there is little reason to hope that demand will be stimulated in the near future by increased purchases for coinage purposes, the producers apparently are anxious that an extensive program of research be undertaken.

There is general confidence that new means will be found to capitalize some of the remarkable properties which silver possesses, and hope that its superiority over all metals as a conductor of electricity can be applied in some way that will call it into use in improving radio equipment or other electrical appliances. More advantage can be taken, it is believed, of its unusual properties of malleability and ductility. Its ability to absorb oxygen opens another field. A small portion of silver added to aluminum is said to impart to that metal all the decorative properties of nickel without the disadvantages that always go with electroplating.

Silver enjoys a prestige that has been accumulating since prehistoric days. In that connection, it may be mentioned that one of the archæological treasures is a record of the establishment in 3,000 B. C. of a ratio under which silver was to be used for current payments.

Director Bain, of the U. S. Bureau of Mines, is anxious to receive further suggestions in connection with this study. He calls attention, however, to the fact that the Bureau of Mines is engaging only in the technical side of the problem.

Assistant to Director Gets New Bureau Duties

Additional duties have been included among those assigned to the assistant to the Director of the Bureau of Mines. In addition to the those already performed, that official in the future will be in immediate charge of the Bureau's estimates and will undertake further administrative work. Hereafter, the division of information and the division of office administration will report to the assistant to the director. The incumbent is E. D. Swanson.

War Minerals Relief

Net losses covered by the War Minerals Relief act have been recommended by Commissioner Briar and approved by the Secretary of the Interior as follows: Lafayette Shelby, $1,314.30; William Wortell, $222.82; National Minerals Co., $8,810.13; John Barrandum & Son, $315; A. E. Englebright, $884.05; Bailey, Hunter Chrome Co., $156.98.

Disallowances were ordered as follows: Liberty Chrome Mines, no further loss; Pacific Tungsten Co., loss resulted from purchase of property; Halsell and Stafford, loss resulted from purchase of property; Simon Aumaier, stimulation not established; Mammoth Mining Co., commercial importance not established; C. J. Hughes, stimulation not established.

Mines Get Power Permits

The Federal Power Commission has authorized a license for the Mount Reubens Mining Co., Grants Pass, Ore., covering the development of water-power in Josephine County, to be used in connection with the company's mining operations.

A preliminary permit has been granted the Consolidated Gold Mines-Alaska, covering a proposed power project on Archangel Creek, in the Knik district, near Wasilla. The power is intended for use in mining and milling.

The preliminary permit issued to the Alaskan Development & Mineral Co., a subsidiary of the Kennecott Copper Co., covering a power development on Annan and Tyee creeks, has been extended for one year.

Three Current Dividend Payers Among British Columbia Mines

THE Premier Gold Mining Co., the Howe Sound mine of the Britannia Mining & Smelting Co., and the Silversmith mine are the three British Columbia mining enterprises at present on a dividend paying basis. The companies have distributed $1,800,000 this year. The Premier's dividend for the third quarter of the year brings its total dividends to $4,450,000. Howe Sound, for the first time in several years, paid a dividend in the second quarter of the present year, $199,208 being distributed. For the third quarter the same dividend has been declared. The Silversmith has paid $100,000 in dividends this year, making a total of $225,000 in the last three years.

Demand for Arsenic Salts Exceeds Supply

Stocks of calcium arsenate have been reduced at an unexpected rate during the latter part of the cotton-growing season, in contrast with comparatively light early purchases of the poison. The slowness with which stocks began to move early in the season alarmed the producers of white arsenic and the manufacturers of calcium arsenate, it is stated, with the result that their operations were curtailed. With the heavy losses of 1922 still in mind, many came to the conclusion that the saturation point had been reached. Instead, it has proved that the heavy buying did not start as early this year as usual.

That situation, in addition to faulty distribution of the material, produced a scramble for existing stocks in certain sections. It is apparent that the demand for calcium arsenate will continue to be in excess of the supply during the coming season.

Saved on Federal Income Tax, Anyway!

An indication of the extent to which the copper-mining industry suffered during 1921 is had from the compilation of tax returns which just has been prepared by the Bureau of Internal Revenue. Of the 149 companies making returns, only 12 had a net income. The 137 others reported deficits aggregating $51,973,346. As a result of this situation, the copper companies paid only $11,913 in federal income taxes during that year. The total net income of the copper-mining companies was $141,924.

The smelting industry did not fare much better. One hundred companies made returns. Eighty-one of those had deficits totaling $17,205,099. The nineteen companies which had net incomes paid only $51,922 in federal income tax, as the total net income was only $489,787.

News from Mining Districts

By Special Correspondents in the Field

Johannesburg Letter

New Modderfontein Breaks Production Record—Find at Bulawayo Starts Brisk Pegging

BY JOHN WATSON

Johannesburg, Oct. 2—The twenty-sixth annual report of the New Modderfontein G. M. Co. was issued on Sept. 18. The tonnage milled (1,340,000) and the gold declared (632,630 oz.) both constitute a record in the history of this company. Two dividends of 50 per cent each have been declared during the year. The company has now yielded a total net profit of £13,304,969; as working expenditure it has distributed more than £12,000,000; and shareholders have received £9,813,750.

According to a recent report from Francistown, a Rand engineer is in the Yukwe area, in the northern part of the Tati concession, reporting on various properties. Several rich finds have been recorded recently, and there is hope of operations on a large scale, in that district.

A Bulawayo prospector, J. W. Painting, recently picked up a piece of quartz, on a native "mealie" (maize) patch, in the vicinity of Urnsingwane, 20 miles from Bulawayo. Examination showed a pinhead of gold. He got his natives working on the patch and on clearing a square yard, to a depth of 15 in., they got out a barrowload of quartz lumps studded with gold. On going down 5 ft. they found a reef 3½ ft. thick. Pegging has been proceeding briskly.

Transvaal Platinum, Ltd., has acquirred additional holdings from the Transvaal Consolidated Lands, Ltd., and South African Townships Mining & Finance Corporation. The former company will receive 12,000 fully paid shares of 5s. each and the latter company a similar number; each company will also be entitled to two seats on the board of directors. The capital of Transvaal Platinum, Ltd., is therefore being increased from £5,000 to £15,321 5s. 6d. Of the new shares, 3,900 are being offered to shareholders at £1 per share, in proportion to their holdings in the company.

At the quarterly meeting of the Transvaal Chamber of Mines held last week, H. O. Buckle, president, protested against the unsympathetic attitude of the Union Government towards the gold mining industry, which has caused the recent shortage of East Coast (Portuguese) "boys." By way of contrast he quoted the sympathetic attitude of the Ontario Minister of Mines. As showing criticism from another quarter, he quoted a letter from one Hendrick van der Walt, which has appeared in certain Dutch Nationalist newspapers, stating that the Chamber has purchased 40,000 morgen of land in his district for the purpose of "growing marcaroni" to feed the mine workers and oust the mealies (maize) now used!

London Letter

Platinum Shares Soar—Labor Trouble in Australia—Electrolytic Zinc Does Well

BY W. A. DOMAN

London, Oct. 26—Mining companies occasionally have queer titles bestowed upon them; such has been the condition for the past thirty or forty years. The question, "What's in a name?" has frequently been asked, and sometimes remained unanswered. And yet the name has a certain amount of sentimental influence upon investors. A company named Rhozambia Mines has recently come before the public. The title connects it with Africa and is pretty comprehensive. It remains to be seen what success will be attained, but a "live" man has sailed for the property to take over the general management, Arthur Dickinson. A gas-producer plant to enable continuous and regular crushing has been ordered and will be shipped forthwith to the mine property.

Some of the Nigerian tin-mining companies whose reports are now making their appearance have had a rather unfortunate experience, seeing that their operations cover a period of low metal prices. One—the Nigerian Tin Corporation—presents accounts for two years to last December and shows a loss of £23,203. On the Kuru property, in the Bukuru district, over 1,000 tons of tin have been proved. On another lease over 150 tons of tin have been proved. On the Keffi area over 5,000 tons of 70 per cent concentrate are shown and on the Bisichi area more than 7,000 tons. Another company—the South Bukeru (Nigeria) Tin—shows a profit for eighteen months of £1,274. For the first twelve months revenue was barely sufficient to cover operating and miscellaneous expenses.

Labor disputes are again reported from the gold mines in Western Australia. The South Kalgurli cables that the millmen are on strike, and refuse to work on Sunday under arbitration conditions. The mine and mill are shut down pending a settlement of the dispute. Other mines are affected, but so far have made no official announcement. The unfortunate part is that a continuous process is used, and the stoppage is naturally awkward. In Australia, arbitration awards are seldom if ever observed by the men.

The Electrolytic Zinc Co. of Australasia has done remarkably well during the twelve months ended June 30 last. The gross profit, after writing off £20,000 from research and development account and placing £90,000 to depreciation, is £401,808, of which £149,115 has been paid in dividends. The output for the period was 31,283 tons of electrolytic zinc; the silver-lead product contained 4,344 tons of lead and 691,052 oz. of silver.

Two Rich Oreshoots in British Columbia

ACCORDING to reports from Rossland, B. C., the I.X.L. mine, where gold ore so high in grade that the railroads did not desire the responsibility of shipment, is producing at the rate of $10,000 per day. The ore is reported as averaging $1,000 per ton.

Ten inches of rich gold-silver ore has been encountered in the Meteor mine, on Springer Creek, in the Slocan district. The ore is expected to yield about $2,000 per ton. The mine is owned by J. C. Buchanan, of Dallas, Tex.

ONTARIO

Propose 5,000-Ft. Shaft for McIntyre

Reports state that J. P. Bickell, president of the McIntyre, is in England with the intention of negotiating for the disposal of the company's unissued treasury stock. At the recent annual meeting the shareholders were advised to the effect that in the comparatively near future it might be necessary to sink a new 5,000-ft. shaft. Funds for the work would necessitate the sale of stock or would have to be met out of the company's earnings. The earnings of the company at the present time are sufficient to permit of increased dividends, and shareholders would prefer the sale of the treasury stock, in order that their immediate returns might be increased. It is reported that the company has purchased the Platt claim of 160 acres, which adjoins the McIntyre on the south and the Schumacher on the east. The Schumacher was purchased some time ago by the Hollinger, as it was proved at depth that the Hollinger veins entered into the Schumacher. The price of the property is understood to be about $400,000.

Castle Tretheway Mill Progresses

The Castle Tretheway silver property in Gowganda is going ahead with the erection of its mill. Underground operations have been stopped in the meantime, to get the mill in operating condition. The company has about 2,000,000 oz. in reserve.

IDAHO

Rich Ore from Marshall Lake Mines

The Marshall Lake district, a few miles south of the Buffalo Hump district, is the scene of a gold strike. The Holte property, which has been producing for several years, encountered a rich streak of ore 18 in. wide which contains gold in large nuggets. The Kentucky mine, adjoining, has encountered ore of like richness on the 400 level. The property is owned by Harvey Peterson, of Bear Creek, and Craig Spencer, of Seattle.

The veins of the Marshall Lake district are extensions of the veins of the Buffalo Hump district.

CALIFORNIA

Washington District, on Mother Lode, Being Opened

After a long period of inactivity new interest is being taken in the East Belt of the Mother Lode in that part known as the Washington district, 27 miles east of Valley Springs. During the last three months new owners have taken over the Sheep Ranch Extension, the John Saltwater, the Enchantress, the Pescier and the Oro Minto (Old Calaveras). The Washington, closed recently by litigation, will be reopened, and preparations are being made to reopen the Sheep Ranch, which was worked down to the 1,700 level. According to a local report there are two vein systems that converge about two miles southeast of the Sheep Ranch mine. The Sheep Ranch and Golden Eagle veins strike northwest and are traceable for a considerable distance. The Indian Creek veins strike northeast and have been opened up at several points, the deepest working being 500 ft. deep. The ore from the Indian Creek veins contains lead, zinc, and arsenic and yields a low recovery by amalgamation. Eastern and San Francisco capital is said to be interested. Initial work is to be confined to exploration.

Mammoth Smelter to Start

The Mammoth Copper Co. has placed men at work in the Sutro mine. At present men are working in the Mammoth, Balaklala, and Keystone mines. It is expected that the smelter at Mammoth will be started some time in November.

Tonopah Belmont Returns Shawmut To Owners

The Belmont Shawmut mine has been shut down and the property is to be returned to its original owners. The Tonopah Belmont Mining Co., after a thorough attempt to make the property pay, has relinquished its control. The property was acquired by the Tonopah Belmont in 1917 and was equipped to produce 400 tons per day. Since operations were resumed late in 1921, after a shutdown beginning in August, 1920, a vigorous attempt was made to put the mine on a paying basis, but without success.

Walker Construction Progresses

Construction work at the Anaconda company's Walker mine, in Plumas County, has reached an advanced stage. The new flotation plant is housed in and the heavy machinery has been installed. The electrical equipment is being connected and the flotation cells are being constructed. The compressor house has been completed, and a large compressor, direct driven, has been installed. The transformer and main switchboard equipment has been placed in position in the compressor house. Heavy machinery has been hauled in from Gulling on the Western Pacific, 19 miles distant; miscellaneous supplies are transported over a wire-rope tram, that connects with Spring Garden on the Western Pacific, a distance of 8 miles. About a month more will be required to complete the new installation. At present 250 tons per day is being treated in the old mill, and the concentrates are now delivered by the wire-rope tram to Spring Garden, from which point they are delivered to the Tooele smelter, in Utah.

NEW MEXICO

Lordsburg Ore Shipments

Ore shipments from the Lordsburg district for the month of September amounted to 8,561.5 tons. The shipments were entirely of siliceous copper ores and went to the smelters at Douglas, Ariz.

Warren Manganese Mine Developed

The development of the S. S. Warren manganese mine, in the Little Florida Mountains, 12 miles southeast of Deming, is moving along steadily under the direction of G. West.

A test car of ore has been shipped for a trial mill run, and another will follow in a few days. This ore runs naturally about 78 per cent manganese dioxide and is free from objectionable minerals.

Tests are being made in an effort to turn out a ground ore suitable for dry-battery purposes. Several hundred tons of this ore was so used during the war. It is understood that contracts for a considerable tonnage extending over a number of years have been offered if the required 80 per cent grade can be met.

WASHINGTON

Good Shoot in Old Dominion

The ore recently found in the Old Dominion mine at Colville is rapidly developing into a real shoot. The orebody was discovered in a winze on the 600 level of the mine and has continued in the winze for over 30 ft., being 5 ft. wide and of unknown length. The ore runs from $100 to $1,000 per ton in gold, silver, and lead content.

The mine has been in operation for several years, but the present strike is the most extensive encountered. One chamber of ore in the mine's early history produced $250,000 net in silver and lead. The mine is owned by the Dominion Silver Lead Mining Co.

COLORADO

Gold King Extension Will Operate

Complete restoration of the Silverton Gladstone & Northern R.R., extending from Silverton to the mining camp of Gladstone, will mark the resumption of traffic, which has been suspended since a disastrous flood in 1921. The rebuilding of this road is the result of resuming operations by the Gold King Extension Mines Co., which is reconstructing the old mill and installing new equipment. The company has developed the mine preparatory to producing as soon as the mill can be put into operation.

NEVADA

George Wingfield Helps Finance Goldfield Property

The Mayflower group of claims, situated in the eastern portion of the Goldfield district, have been taken over by the Luetjens Goldfield Mining Co., of which George Wingfield is president and Fred H. Luetjens vice-president. The fact that George Wingfield has agreed not only to become president of the company, but to advance some funds for development, has produced a feeling of optimism in Goldfield. The general sentiment is that if Wingfield takes an active interest in the company it will be properly financed and the ground thoroughly prospected. Surface sampling and panning indicate consistent low values across wide widths for a long distance along the strike of the vein. This group of claims was originally owned by the Mayflower Gold Mining Co., organized in 1904, and a few shallow shafts were sunk at widely separated points, all some distance from the present vein. It has been dormant for several years.

Tonopah Bullion Shipments

Three mining companies of the Tonopah district recently shipped gold and silver bullion valued at approximately $165,000, representing operations during the first two weeks of October. The Tonopah Extension shipment was valued at $74,000, the West End $44,000, and the Tonopah Mining Co. $47,000.

Knox Abandons Landmark Bond

The option on the Landmark group of claims at Tolicha, about 40 miles south from Goldfield, held by Charles E. Knox and associates, has been relinquished. All equipment which could be moved under the terms of the option has been removed. It is said that owners will continue work on their own account.

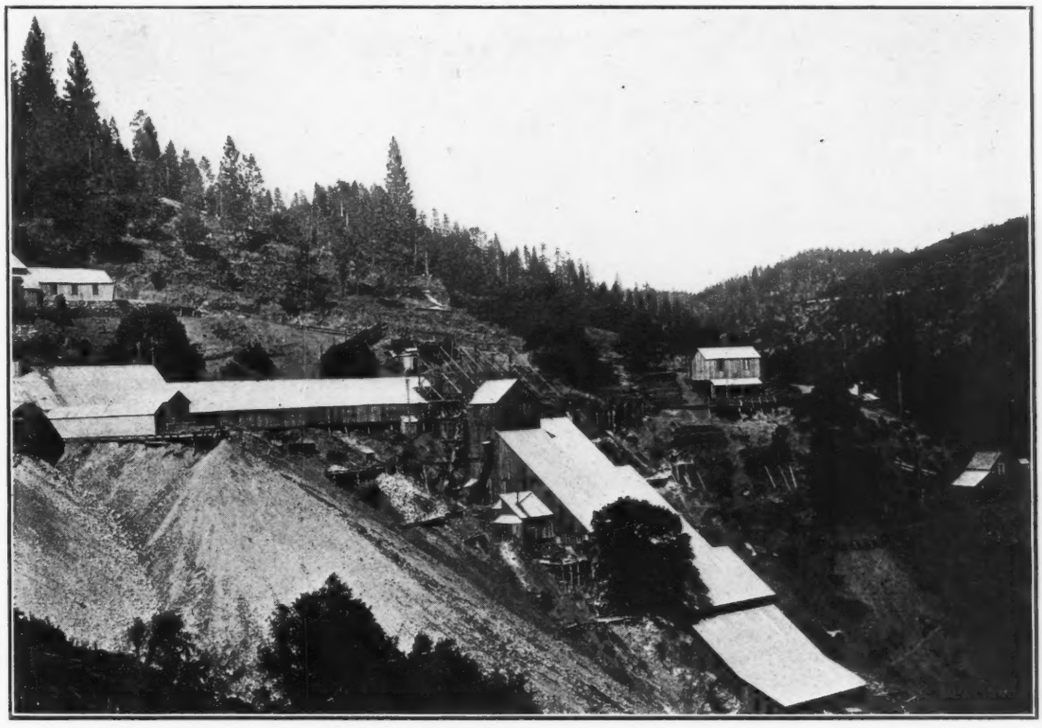
New Placer Ground Found

It is reported that Thomas "Dry Wash" Wilson, who was one of the first to profitably work the placer deposits of Round Mountain and Manhattan, has found a new gravel channel about one mile southwest of the hill called Round Mountain, which carries high-grade gravel. The pay gravel was struck in a vertical shaft at a depth of 223 ft., and the shaft has been in gravel which will run from $4 to $8 per yard for the last 15 ft. The channel should enter Round Mountain ground, and if values continue as indicated by present meager developments will add materially to the value of that company holdings.

UTAH

Grading Starts for Chief Con. Mill

A site has been chosen for the new mill of the Chief Consolidated near the No. 1 shaft. Grading has been started, and it is expected to have the plant in operation by spring. The company is offering stock to present stockholders at $3 a share, so as to assist in financing the new project without reducing the present cash surplus.



Gold mining in California is far from inactive. This plant of the Sixteen to One Mine under construction at Allegheny is typical of many small mills

MICHIGAN

Quincy Alone Cuts Wages

Although a wage cut of about 50c. per day has been announced in the West, there has been no general wage reduction in the Michigan copper district. To date, the Quincy Mining Co. has been the only one to announce a wage decrease—10 per cent, immediately effective.

The wage schedule in Butte, for instance, has been higher than in the Lake Superior copper region and is still larger, even with the 50c. per day decrease. In Montana, underground labor has been receiving $5.25 per day and miners engaged in shaft work, station cutting, and winzes, $5.75 per day. The reduction will make wages $4.75 and $5.25, respectively. In Michigan, the average wage for underground workers is $4.25, company account, although contract men make in excess of this.

The Michigan wage is as high as can be paid under present metal conditions, in a deep mining field where costs are in excess of per-ton costs in the West and Southwest. Other compensations, although indirect, such as relatively cheap living costs, have helped make up the difference as between wages in the Michigan field and other copper camps.

Seneca Increases Output Gradually

A second skip is now operating in Seneca No. 1 shaft, and the work of building switch tracks at the shaft is nearing completion. Shipments have been going forward to the Ahmeek mill at the rate of about 250 tons per day, but with the completion of the tracking facilities, Seneca will be in a position steadily to increase the amount of its daily tonnage, which will be brought up to 600 tons at Seneca shaft. It is expected Gratiot No. 2 shaft will be ready for regular production within two months.

Norrie Shaft Will Be Deepened for Prospecting

The Oliver Iron Mining Co. has begun the work of sinking the "A" shaft of the Norrie mine, on the Gogebic range, an additional 500 ft. below the 27th level. The shaft is 6 by 23 ft. inside of timbers, with three hoisting compartments. Its long axis is parallel with the formation, and the shaft dips with the formation at 58 deg. Sinking was first started in 1900; the shaft was the first on the range to have steel sets. These were built up out of rails, channels, and I-beams, and were spaced at 4 ft. centers. The sets to be used in the present work are to be built of "H" and "I" beams, and will carry concrete lath instead of the wood lath as formerly used. The work will be carried on under a heavy timber pentice, and hoisting will be done through a short winze extending from the 27th level station down into the cage road below the pentice.

There are no known orebodies that the shaft will open up; it is being sunk merely for exploratory purposes, as drilling has been unsatisfactory under the local conditions.

MINNESOTA

Iron-ore Shipments Exceed 54,000,000 Tons

Iron-ore shipments from the Lake Superior district on Nov. 1 reached a grand total of 54,088,244 tons for the season. This compares with 39,192,624 tons as of Nov. 1, 1922. The tonnage for the month of November totaled 8,099,124, which is a gain of approximately 2,000,000 tons over the 1922 shipments for the same period. The season is rapidly drawing to a close, and many delays result from unnavigable weather on the Lakes. Freezing of the ore in the cars while in transit necessitates thawing before it can be dumped into the dock pockets. Nevertheless, a good tonnage will be moved before the shipments are discontinued.

JOPLIN-MIAMI DISTRICT

Schwab Properties Produce Well

The Chubb and Tom L. mines of the Quapaw Mining Corporation, a C. M. Schwab company, have proved excellent producers in the few months they have both been operating. The Chubb, at last accounts, had produced 7,791 tons of zinc concentrates and 382 tons of lead, and the Tom L. 2,920 tons of zinc and 878 tons of lead. The value of these shipments is close to half a million dollars. The Quapaw Company soon will have its Wolverine mine, west of the Quapaw, operating, and there are a number of other mills on its acreage that can easily be put into production if the dewatering campaign now under way meets with success.

The Situation at the Mines

By Arthur B. Parsons
Assistant Editor

"CUT COSTS" is the watchword and the hope of salvation for the present of the copper-mining companies. They have been cutting for some time, but necessity says "cut more." To this end producers in the West reduced wages about 50c. per shift, effective Nov. 1. This applies to Butte, Mont.; Bingham, Utah; Ely, Nev.; Santa Rita, N. M., and Ajo, Bisbee, Jerome, the Globe-Miami district, and Clifton—all in Arizona. In Michigan the Quincy company has posted a parallel cut, but Calumet & Hecla and the others have as yet made no announcement. What will happen in the Coeur d'Alene district, in Idaho, in the silver-lead districts of Utah, in Colorado, Nevada, and California remains to be seen.

The new scales are the same as those prevailing during all of 1922 and until March of this year, when a general increase went into effect. The copper-mining companies were expanding their operations at the time on a climbing copper market and the measure taken to attract the necessary men was to raise wages.

The present cut is directly attributable to the decline in the price of copper, which has been hovering around 12¼c.,

Estimated Current Rate of Copper Production in Pounds per Month

Anaconda	17,000,000	Kennecott	5,500,000
Arizona Commercial	800,000	Miami	5,000,000
Braden	12,000,000	Moctezuma (P. D.)	3,400,000
Calumet & Arizona	3,225,000	Mohawk	950,000
Calumet & Hecla Con	7,500,000	Mother Lode Coalition	3,000,000
Cerro de Pasco	11,000,000	Nevada Consolidated	6,000,000
Chile	19,000,000	New Cornelia	3,500,000
Chino	4,000,000	Old Dominion	2,000,000
Copper Range	2,200,000	Phelps Dodge (U. S.)	9,800,000
Davis Daly	600,000	Quincy	1,000,000
East Butte	450,000	Ray	6,000,000
Engels	1,200,000	United Verde	8,300,000
Granby Consolidated	3,000,000	United Verde Ex	3,500,000
Greene Cananea	3,000,000	Utah Consolidated	1,000,000
Howe Sound	2,500,000	Utah Copper	19,500,000
Inspiration	7,500,000	Walker	720,000
Katanga (Africa)	11,000,000		

compared with an average of 16.85c. in March. The decline since has been comparatively uniform and the profits of producers have been reduced seriously—in fact, to extinction in many instances. No pretense is made that the cost of living warrants a cut in wages; the question is purely one of reducing expenses in an effort on the part of "high-cost" producers to avoid shutting down. The employees themselves may derive some meagre consolation in the knowledge that on a starvation copper market the industry as a whole is earning little or nothing and that a job at $4.75 is better than a $5.25 wage scale and no job at all.

Incidentally, the return to the mines of many experienced workers who spend the summer in other industries or in outlying mining camps on development work has relieved the shortage of miners to some extent. The present base in Arizona is $4.95, at Butte $4.75, and at Bingham $4.25 for underground miners. In Butte much work is done on a contract basis, but the contract rates will be cut in proportion to the reduction in day's pay.

Serious as the situation is, not one of the important producers—except North Butte, which suspended in July—has shut down. A number have curtailed production somewhat, and a few have increased; the aggregate current output is somewhat smaller than it was last August, which was probably the highest month. The accompanying table shows estimates of the current output.

The most important event for a long time in lead mining is the closing of the transaction whereby the St. Joseph Lead Co. acquires all of the mining and milling property of the Federal Lead Co., a subsidiary of the A. S. & R. Co., in the "disseminated" lead district centering at Flat River, in Southeastern Missouri. The district produces more than half of the domestic lead output of the United States, and the St. Joe company now overwhelmingly dominates the industry there. The holdings of the two companies adjoined and "checkerboarded" each other in such a manner that mining operations could not be conducted with the best efficiency by either. Negotiations have been under way for a year; the final terms involved a payment of $10,000,000 and as an additional consideration a 30-year contract for the A. S. & R. Co. to smelt two-thirds of the ore produced. Low-grade deposits that could not be worked at all will become profitable under the new arrangement. Elsewhere lead mining is sailing on an even keel with the market satisfactory at 6¾c., just a trifle lower than it was a month ago.

During October zinc fell off from 6.65c. to 6.32c. This brought the price of concentrate in the Joplin-Miami district to around $40 per ton, at which 19,000,000 lb. was marketed during the last week in the month. This was much in excess of production, but a considerable surplus stock is still on hand and a one-week production holiday starting Nov. 5 is being observed by two-thirds of the operators. They are very uncomfortable when the stock gets too large, and another week of non-production will be designated for December.

The shutdown of Butte & Superior in Montana proved short. Arrangements have been made to concentrate Butte & Superior zinc ore in the Anaconda plant, and, with the shaft repairs completed, production at the company's Black Rock mine is again under way. Anaconda's effort to stimulate zinc production in the Coeur d'Alene likewise have borne fruit. Both the Constitution and Nabob companies have signed contracts and will soon be shipping concentrate to the electrolytic plant at Great Falls.

In California, gold miners say little, but keep producing. The virtues of a steady market are recognized. True, the commodity-value of gold changes, but the fluctuations are neither so frequent nor so sudden nor as hard to foresee as is the case with the other metals. Tonopah bullion shipments totaled $300,000 in October, which is "normal" for post-Pittman days. No serious shortage of miners exists in either California nor Nevada.

The Chief Consolidated, leading silver-lead producer of the Eureka district, in Utah, has started the construction of a mill to treat complex low-grade ores. Little change is noted in production rates. Lead production in the Coeur d'Alene district is estimated at 18,500 tons below normal, because of inactivity at the Hecla and Callahan mines. The Silver Dyke company, American Z., L. & S. subsidiary, is increasing the capacity of its 400-ton mill at Neihart.

Estimated production in Colorado is gold, 2,500 oz.; silver, 350,000 oz.; copper, 350,000 lb.; lead, 2,225,000 lb., and zinc, 3,750,000 lb.

In the Joplin-Miami district mills continue to go up. The Kansas Exploration and Kanok Metals Co. each are finishing 250-ton plants and the Tulsa Quapaw company is building a 600-ton concentrator.

On the Lake Superior iron ranges shipments are being interfered with already by the cold weather. However, a good tonnage will be added to the 54,000,000 already hauled this season. New development and construction work during the winter months will be important.

An increase of wages, instead of a decrease, was made by the International Nickel Co. at Sudbury, Ont. The company wants better miners and is taking this means to get them. Production from the three mines in the district is at the rate of 4,000,000 lb. copper and 7,000,000 lb. nickel per month. The new Britannia mill of the Howe Sound company, in British Columbia, is making a 20 per cent copper concentrate from 2,700 tons of ore per day—better than expectations. The Federal M. & S. Co. has started shipments from its Duthie mine.

From ports of entry on the Mexican border come the significant reports of largely increased importations of mine and mill machinery from this country. Nothing could be a surer sign of mining activity.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
1	12.25@12.375	41.50	42.00	6.75	6.45@6.50	6.325
2	12.375	41.00	41.50	6.75	6.45@6.50	6.325
3	12.375	41.00	41.50	6.75	6.40@6.50	6.325
5	12.375	41.375	41.875	6.75	6.45	6.35
6	.....	.....	.....	....	....	.....
7	12.375@12.50	43.00	43.50	6.75	6.45	6.35
Av.	12.375	41.575	42.075	6.75	6.46	6.335

*These prices correspond to the following quotations for copper delivered: Nov. 1st, 12.50@12.625c.; 2d, 3d, and 4th, 12.625c.; 7th, 12.625@12.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
1	60½	61⅛	64½	208⅝	205⅝	29	27	33½	32¾
2	60½	61⅛	64¼	208¼	205¾	29½	27¼	33¼	32¾
5	60¾	61¼	64	208¼	207⅜	30	27⅜	33¼	32⅞
6	61⅛	61⅝	64½	213	213	29¾	27½	33	32⅞
7	61¼	61¾	64½	216	215¾	29¾	27⅝	32⅝	33

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
1	4.47¾	63⅜	31 15/16	92s 0d	5	4.46	63⅛	32 1/16	92s 6d
2	4.46½	63	31¾	92s 5d	6	.....	...	32 1/16	92s 5d
3	4.45⅝	63¼	32	.....	7	4 45¼	63⅜	32	92s 7d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Nov. 7, 1923

The non-ferrous metal markets have generally been quiet. Copper prices continue to show improvement, with consumers manifesting greater interest in the market. The change in the trend of the stock market and a belief in the soundness of industrial activity may have had something to do with this situation. The lead market has remained steady, showing no tendency to move in either direction. The market for slab zinc is practically unchanged.

Copper

Sales of copper were fair, especially considering that the last week was a shorter one than usual because of the holiday. Some producers report better business than they have done for weeks; others have either remained out of the market entirely or have been contented in making only a few moderate-sized sales. At least one of them found such satisfaction in the volume of his participation in export sales that he did not press any copper on the domestic market. Last Thursday the metal was sold for 12¼c. delivered, the lowest price for the week, the price moving up to 12⅝c., which was the general selling level for most of the business that was done. Copper for delivery in November and December can still be obtained at 12⅝c., provided delivery charges are not too high, but by far the majority of producers are asking 12¾c. delivered, at which level some sales have already been made. Consumers are inclined to favor purchases of forward copper rather than prompt metal. Most of the copper sold is going into wire mills and the manufacture of cable. Brass manufacturers do not seem to be interested. The manufacture of cable incidentally accounts for much lead and aids the lead as well as the copper market.

Export business has not been satisfactory.

Lead

The official contract price of the American Smelting & Refining Co. remains at 6.75c. per lb., New York. This is the price that other producers are also asking and receiving. The premium on spot delivery that was a feature of the New York lead market a few weeks ago is difficult to obtain, and then only under exceptional circumstances. The market in St. Louis has varied between 6.45c. and 6.50c. One sale is reported at 6.40c., of a good tonnage. The volume of business done in both markets has been fair. Bonded lead for prompt delivery in New York is scarce and commands a premium, or, rather, the differential between it and the price of domestic lead has become narrower. As high as 5.75c. has been obtained for this class of lead. It is used by manufacturers who fashion exportable materials and who wish to save the difference between the cost of foreign lead and that from American mines. Lead from foreign ores carries a tariff of 1½c. per lb.; that from foreign bullion a tariff of 2⅛c. per lb. The manufacturers mentioned above make a saving on these tariff charges by purchasing bonded lead.

Consumption of lead is still good. Corroders say that the demand for pigments is keeping up splendidly, particularly in the East. Mixed-metal manufacturers report a satisfactory season. The outlook for storage-battery manufacturers is considered favorable. One large consumer of lead says that he has had difficulty in obtaining the metal when he wanted and ordered it, as his supplier was continually behind in shipment.

Zinc

The slab zinc market has been listless, and prices have ranged from 6.30 to 6.35c. Sales have been light, with consumers desiring only small tonnages. Export business has not been feasible, but may come again should the London and American markets draw apart sufficiently to permit it. Sales of high-grade zinc continue to be made regularly and satisfactorily by the leading producers at unchanged prices of 8¼ to 8½c. per lb., depending upon the point of delivery. The New York price of Prime Western is 35c. per 100 lb. above that of East St. Louis.

Tin

The premium on spot tin in London, which was £3 5s. on Oct. 31 over the price of foreign, became smaller during the week, and today these positions are almost on a parity with each other. The price of Straits tin on last Friday declined in sympathy with the heavy arrivals that came into port.

Arrivals of tin during October, 6,885 long tons. Nov. 1st, Straits, 55; Java, 75; 2d, Straits, 25; Liverpool, 25; 5th, Straits, 1,595; China, 75; Liverpool, 200.

Foreign Exchange

Fluctuations in exchange during the week were of minor importance. Francs have ruled slightly lower than last week. On Monday, Nov. 5, francs were 5.78c., lire 4.46c., and Montreal funds in New York, 1⅛ per cent discount.

Silver

The Indian bazaars continue to buy, and the market closes quiet but steady.

Mexican Dollars—Nov. 1st, 48⅜; 2d, 48; 3d, 48¼; 5th, 48½; 7th, 48⅜.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 26@27c. per lb.; 98 per cent, 25@26c. London, £115 per long ton.

Antimony — Chinese and Japanese brands 9¼c. W.C.C. brand 9½@10c. Cookson's "C" grade, 12@12½c. Chinese needle antimony, lump, nominal, 6.50c. per lb. Standard powdered needle antimony (200 mesh), 7@8c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 7.50@8c.

Correction—The prices of ordinary Chinese and Japanese brands and W.C.C. antimony should have been interchanged in last week's report.

Supplies scarce. Political trouble in China affecting production.

Bismuth—$2.55 per lb. London, 10s.

Cadmium—75@80c. per lb. London, 2s. 9d. Market weaker on account of cheap Australian supplies in London.

Cobalt—$3 per lb. for spot.

Iridium—$275@$300 per oz.

Nickel—27@32c. per lb. for 99 per cent virgin metal. London, £125@£130 long ton.

Palladium—$80 per oz.

Platinum—$120@$125 per oz. London, £25.

Quicksilver — $62 per 75-lb. flask. Steady. San Francisco wires $61.35. London, £9 5s.

The prices of **Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium,** and **Tungsten are unchanged from** prices given Nov. 3.

Metallic Ores

Tungsten Ore—High-grade wolframite, $8.50; high-grade scheelite, $9@$9.50 per unit. Ordinary grades, $8@$8.25.

Chrome, Iron Ore, Magnetite, Manganese, Molybdenum, Titanium, Vanadium, and **Zircon Ore** are unchanged from the quotations published Nov. 3.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 3—Zinc blende, per ton, high, $41.80; basis 60 per cent zinc, premium, $41@$42; Prime Western, $40@$41; fines and slimes, $40@$37; average settling price all blende, $39.85; calamine, basis 40 per cent zinc, $24@$28.

Lead, high, $82.80; basis 80 per cent lead, $80@$79; average settling price, all lead ore, $80.08 per ton.

Shipments for the week: Blende, 13,857; calamine, 80; lead, 1,402 tons. Value, all ores the week, $668,150.

The purchase of 14,760 tons from unwilling sellers necessitated a higher price level before any quantity of ore was purchased, resulting in the sale of the week's output. Next week is closing week again, and some mines closed last night and others were to close tonight, but no report has been issued as to the reduction that may be made in the output. If restricted by 10,000 tons it should hold the price from seeking a lower level and may even strengthen the market for ore and metal.

Platteville, Wis., Nov. 3.—Blende, basis 60 per cent zinc, $43 per ton. Lead, basis 80 per cent lead, $80 per ton. Shipments for the week: Blende, 549 tons; lead, none. Shipments for the year: Blende, 27,145; lead, 650 tons. Shipments for the week to separating plants, 914 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $350@$450; No. 2, $200@$250; spinning fibers, $100@$125; magnesia and compressed sheet fibers, $60@$90; shingle stock, $50@$65; paper stock, $30@$40; cement stock, $17@$20; floats, $6@$12. **All f.o.b. mines, per short ton, Quebec.**

Barytes, Bauxite, Beryl, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Graphite, Gypsum, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, Talc and Tripoli are unchanged from the Nov. 3 prices.

Mineral Products

Arsenious Oxide (white arsenic)—13@13½c. per lb.

Copper Sulphate—4.90@5c. per lb., domestic product.

Potassium Sulphate, Sodium Nitrate, and Sodium Sulphate are unchanged from quotations of Nov. 3.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, generally obtainable at $110 per gross ton, f.o.b. works. Spiegeleisen, 19@21 per cent, $42; 16@19 per cent, $41.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from the prices published Nov. 3.

Metal Products

Copper—Sheets, 20¼c. base; wire, 15c.

Lead Sheets—Cut, 10.50c.; full, 10.25c. per lb.

Nickel Silver—18 per cent Grade A sheets, 27½c.

Yellow Metal — Dimension sheets, 18c.; rods, 15c.

Zinc Sheets—Base price, **$9.25 per 100 lb., f.o.b. plant.**

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and Zirkite are unchanged from the Nov. 3 prices.

The Iron Trade

Pittsburgh, Nov. 6, 1923

The volume of finished steel buying keeps up very well and better than was expected. The rate since Oct. 1 has been higher than during September, but has perhaps decreased a trifle in the past two or three weeks.

While incoming business in steel products falls quite short of shipments, the shipments are well maintained, production declining only at a slow rate. There are now strong prospects that steel prices will hold through the year, and the chances of their holding into the new year have become somewhat favorable.

Pig Iron—The market continues practically stagnant. Consumers seem to think prices will more likely decline than remain at the present level. Foundry remains at $22.50, Valley and bessemer at $25, Valley, while basic, recently nominal at $24, is now regarded as being at $22, Valley.

Connellsville Coke — Youngstown Sheet & Tube Co. has sold 15,000 to 16,000 tons of byproduct coke, months November to March inclusive, to the Struthers Furnace Co., at a price below what the Connellsville region could make. Spot market unchanged at $3.75@$4 for furnace and $5@$5.50 for foundry.

Freight Rates on Metals, Ores, and Concentrates

In Carload Lots

Copper Bullion and Refined Copper

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
El Paso, Tex.	Baltimore, Md.	$13.40	.....
Garfield, Utah	Perth Amboy, N. J.	12.50	.....
Garfield, Utah	San Francisco	5.85	.....
Hayden, Ariz.	Perth Amboy, N. J.	16.50	$12.50
Miami, Ariz.	Perth Amboy, N. J.	16.50	12.50
Anaconda, Mont.	Perth Amboy, N. J.	12.50	.....
Butte, Mont.	Perth Amboy, N. J.	12.50	.....
Humboldt, Ariz.	Chrome, N. J.	16.50	12.50
Douglas, Ariz.	Perth Amboy, N. J.	16.50	12.50
Globe, Ariz.	Perth Amboy, N. J.	16.50	12.50
Clifton, Ariz.	Perth Amboy, N. J.	16.50	12.50
Clarkdale, Ariz.	Chrome, N. J.	16.50	12.50

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
Copperhill, Tenn.	Laurel Hill, N. Y.	$10.80	.....
Tooele, Utah	Chrome, N. J.	12.50	.....
McGill, Nev.	Baltimore, Md.	15.90	.....
Houghton, Mich.	New York	(a)9.60	.....
Hancock, Mich.	New York	(a)9.60	.....
Hubbell, Mich.	New York	(a)9.60	.....
Dollar Bay, Mich.	New York	(a)9.60	.....
Tacoma, Wash.	New York Conference rate	$6.00 via Canal	
Anaconda, Mont.	Tacoma, Wash.	7.09	.....
Ajo, Ariz.	New York	16.50	*$12.50

(a) Applies April 1 to Nov. 30 of each year.

Lead Bullion; (Pig Lead Where Shown)

From	Rates per Ton of 2,000 Lb. To New York	To St. Louis
East St. Louis, Ill.	$7.00	.....
Pueblo, Colo.	14.15	$9.65
Leadville, Colo.	16.50	11.40
East Helena, Mont	16.50	11.40
El Paso, Tex.	(c) 12.00 Via Gulf	
	(c) 14.00 All Rail	(b) 7.76½
Omaha, Neb.	9.60	3.65
Murray, Utah	16.50	11.40
Midvale, Utah	16.50	11.40
Tooele, Utah	16.50	11.40
East Chicago, Ill.	6.40	(a) 2.00
Kellogg, Idaho	16.50	11.40
Carnegie, Pa.	3.80	(a) 5.00
Selby, Calif.	(d) 6.00	.....
Herculaneum, Mo.	(a) 8.80	(a) 1.80
Federal, Ill.	7.00	(a) 1.80
Collinsville, Ill.	7.00	(a) .75½
Granby, Mo.	(a) 10.50	(a) 3.50
Joplin, Mo.	(a) 10.50	(a) 3.50

(a) Pig lead only.
(b) Pig lead only when originating in Mexico.
(c) Shipments of bullion originating in Mexico, $2 per ton less.
(d) Conference rate, via canal.

Slab Zinc

From	Rates per Net Ton to E.St.Louis	New York
Donora, Pa.	(a) $4.60	$3.80
Langeloth, Pa.	(a) 4.60	3.80
Palmerton, Pa.	7.10	3.00
Hillsboro, Ill.	1.40	7.00
Danville, Ill.	2.00	6.40
La Salle, Ill.	2.00	6.70
Springfield, Ill.	3.00	7.00
Cleveland, Ohio	5.80	5.00
Moundsville, W. Va.	4.40	3.80
Van Buren, Ark.	3.80	10.80
Fort Smith, Ark.	3.80	10.80
Bartlesville, Okla.	3.50	10.50
Blackwell, Okla.	3.80	10.80
Henryetta, Okla.	3.80	10.80
Sand Springs, Okla.	3.80	10.80
Cherryvale, Kan.	3.50	10.50
Black Eagle, Mont.	*9.40	*12.50
Park City, Utah	9.00	*12.50

(a) To St. Louis, Mo.

Zinc Ores and Concentrates

To	From	Rate per Net Ton
Bartlesville, Okla.	Altoona, Kan.	$2.10
	Pittsburg, Kan.	*1.09
	Galena, Kan.	1.30
	Joplin, Mo.	1.40
	Iola, Kan.	*1.09
	Baxter, Kan.	1.40
	Miami, Okla.	1.40
	Quapaw, Okla.	1.40
	Kansas City, Mo.	1.60
	Miami, Okla.	2.20
	Quapaw, Okla.	2.20
Sand Springs, Okla.	Galena, Kan.	1.50
	Joplin, Mo.	1.50
	Iola, Kan.	2.40
	Cave Springs, Mo.	2.00
	Cent City Spur, Mo.	2.00
Dewar, Okla.	Chitwood, Mo.	2.00
Kusa, Okla.	Galena, Kan.	1.50
Henryetta, Okla.	Iola, Kan.	2.40
	La Harpe, Kan.	2.40
	Mound City, Kan.	.50
La Harpe, Kan.	Oswego, Kan.	.50
	Parsons, Kan.	.50
Coffeyville, Kan.	Galena, Kan.	1.10
	Joplin, Mo.	1.22
	Baxter, Kan.	1.80
Bartlesville, Okla. (a)	Miami, Okla.	1.80
	Quapaw, Okla.	1.80

(a) Lead ore and concentrates.

Rates on Ores and Concentrates

From	To	Value of Product $5	$10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate														
Butte, Mont.	Anaconda, Mont.	.17	.17	.17	.17	.17	.17	.17	.17	.17	.17	.17	17	.17	.17	.17
Butte, Mont.	Black Eagle, Mont. (a)	....	....	....	....	....	....	....	1.01	....	....	....	....	....	....	....
Great Falls, Mont.	East Helena, Mont.	....	....	1.57	....	1.76	....	1.98	....	2.43	....	....	....	....	....	2.55
Butte, Mont.	East Helena, Mont.	....	....	1.17	....	1.46	....	1.69	....	2.03	....	....	....	....	....	2.14
Paxton, Calif.	Salt Lake Smelters, Utah	....	....	....	....	....	....	....	....	6.30	7.00	7.70	....	8.35	8.60	8.85
Johannesburg, Calif.	Selby, Calif.	....	....	....	2.90	....	3.50	....	4.10	4.70	5.30	5.90	....	6.50	6.80	7.10
Johannesburg, Calif.	Humboldt, Ariz.	....	....	....	3.40	....	4.10	....	4.80	5.50	6.20	6.90	....	7.60	8.00	8.30
Fioche, Nev.	Humboldt, Ariz.	....	4.50(c)	7.74	....	8.55	....	9.36	....	9.99	....	....	11.25	....	....	12.42
Creede, Colo.	Durango, Colo.	....	....	3.25	3.50	3.75	4.00	....	4.25	4.75	5.25	5.75	6.05	....	....	7.10
Ouray, Colo.	Durango, Colo.	....	....	4.30	4.80	....	5.05	....	....	5.90	....	6.30	....	....	....	7.70
Kokomo, Colo.	Durango, Colo.	....	6.00	....	....	6.50	7.20	....	....	....	....	....	....	....	....	....
Telluride, Colo.	Durango, Colo.	....	....	....	....	....	4.30	....	5.00	5.90	6.30	6.30	....	....	....	7.70
Silverton, Colo.	Durango, Colo.	....	....	1.40	1.40	....	....	2.20	....	....	2.30	2.55	....	2.80	....	2.80
Tyrone, N. M.	Douglas, Ariz.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.40	....	....	3.80
Tyrone, N. M.	El Paso, Tex.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.40	....	....	3.80
Lordsburg, N. M.	Douglas, Ariz.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Lordsburg, N. M.	El Paso, Tex.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Tombstone, Ariz.	Douglas, Ariz.	....	....	.60	....	.90	....	....	....	1.30	....	....	1.60	....	....	1.90
Tombstone, Ariz.	El Paso, Tex.	....	....	1.90	....	2.50	....	....	....	3.80	....	....	4.40	....	....	4.40
Silver City, N. M.	Douglas, Ariz.	....	....	2.48	....	3.15	....	....	....	3.83	....	....	....	....	....	5.29
Ray Junction, Ariz.	Hayden, Ariz.	....	.10	....	.40	....	.50	....	.80	.90	....	....	1.00	....	....	1.10
Sandon, B. C. / Alamo Concentrator, B. C.	Tadanac, B. C.	1.50	1.60	1.70	1.90	2.00	2.50	....	2.60	2.90	3.40	3.50	....	3.70	3.80	3.90
Rossland, B. C.	Tadanac, B. C.	.90	.90	1.00	1.00	1.10	1.50	....	1.60	1.60	1.60	1.70	....	1.70	1.70	1.70
Rossland, B. C.	Tadanac, B. C(d).	.30	.30	.30	.30	.50	.70	....	.80	.80	....	....	....	....	....	....
Republic, Wash.	Tadanac, B. C.	....	2.02	2.50	2.66	2.86	3.84	....	3.84	3.84	4.69	4.89	....	5.19	5.39	5.59

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Siliceous ore tailing.
(d) Applicable on ore, only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

Rates on Ores and Concentrates

From	To	Value of Ores and Concentrates $10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate													
Burke, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.68	....	.....	....	....	1.02
Burke and Wallace, Idaho	East Helena, Mont.	....	....	....	....	3.00	....	3.25	3.50	3.75	4.00	.....	4.25	4.50	4.75
Sagel, Idaho	East Helena, Mont.	....	....	....	3.38	....	3.83	....	4.16	....	....	.....	....	....	4.84
Arizona Tunnel, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.35	....	.....	....	....	.50
Bayview, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	3.75	....	....	4.37½	....	....	5.12½
Park City, Utah	Salt Lake Smelters	1.00	1.10	1.25	....	1.50	....	1.75	....	2.00	....	.....	2.25	....	2.50
Eureka, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Tintic, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
St. Johns, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Ophir, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Bingham, Utah	Garfield, Utah	....	.40	....	.75	....	....	....	.95	....	....	1.10	....	....	1.25
Cherry Creek, Nev.	Garfield, Utah (c)	....	....	4.60	....	5.10	....	5.60	6.10	6.60	7.10	.....	7.60	8.10	8.60
Cherry Creek, Nev.	Garfield, Utah (b)	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	....	....
Goldfield, Nev.	Salt Lake Smelters	....	....	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Battle Mountain, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.80	....	4.40	5.00	5.60	6.20	.....	6.80	7.40	8.00
Palisade, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.80	....	4.40	5.00	5.60	6.20	.....	6.80	7.40	8.00
Mina, Nev. (a)	Salt Lake Smelters	....	....	3.60	....	4.30	....	5.00	5.70	6.40	7.10	.....	7.80	8.50	9.20
Lovelock, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Golconda, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Hazen, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Tonopah, Nev.	Salt Lake Smelters	....	....	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Rogerson, Idaho	Salt Lake Smelters	3.00	....	3.50	....	4.00	....	4.50	5.00	5.50	6.00	.....	6.50	7.00	7.50
Georgetown, Colo.	Leadville, Colo.	....	....	3.50	....	3.75	....	4.00	5.00	5.00	5.80	.....	5.80	5.80	5.80
Shirley, Colo.	Leadville, Colo.	....	....	2.25	....	2.25	....	2.25	2.25	4.30	4.30	.....	4.30	4.30	4.30

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb.
*Indicates a change of tariff since last report.

COMPANY REPORTS

The Buena Tierra Mining Co., Ltd.

Silver, Lead; Mexico

A report of operations of the Buena Tierra Mining Co., Ltd., for 1922 states that during the first half of the year the mine was operated under lease, the royalties resulting therefrom amounting to $9,392.61.

During the second part of the year the company resumed the operation of the mine, and an operating profit of $21,682.87 was earned during that period, after deduction of all costs of development and exploratory work by diamond drills.

After making provision for London expenses, insurance, loss of exchange and other items and writing off the commission and expenses in connection with the issue of 10 per cent five-year notes, the working profit for the year is converted into a loss of £2,119 7s. 11d., making the total debit to profit-and-loss account £59,319 2s. 7d.

Shipments amounted to 5,752 short tons averaging 16.1 oz. silver and 14 per cent lead. Production costs were $18.79 per metric ton.

Lake Shore Mines, Ltd.

Gold and Silver; Ontario

A report of the Lake Shore Mines, Ltd., for the nineteen months ending June 30, 1923, shows a profit of $168,268.99 as follows:

Income			
Bullion production	$833,664.89		
Exchange on bullion sales	16,618.03		
		$850,282.92	
Interest earned, Dominion of Canada bonds	$8,924.65		
Other	6,780.41		
		15,705.06	
			$865,987.98
Expenses			
Operating, development, mining, milling, maintenance, general expense, and Ontario mining tax, after deducting sundry revenue	$412,559.70		
Administrative	18,745.21		
		$431,304.91	
Provision for depreciation on buildings, structures, and equipment	$63,614 37		
Exhaustion of mine	290,000.00		
Dominion Government taxes	11,799.71		
		$265,414.08	
Donation, Haileybury fire relief fund		1,000.00	
			$697,718.99
Profit for period			$168,268.99
Less dividends Nos. 10, 11, 12 and 13			160,000.00
Balance, carried forward, as set out on balance sheet			$8,268.99

Balance sheet as of June 30, 1923, is given as follows:

Assets

Cash and bank balances		$125,716.90	
Bullion products on hand		48,418.79	
Accounts receivable	$3,927.13		
Less provision for doubtful accounts	133.25		
		3,793.88	
Supplies on hand		40,671.70	
Bonds, Dominion of Canada		252,488.28	
			$471,089.55
Buildings, structures and equipment		$378,412.43	
Less provision for depreciation		174,438.22	
			203,974.21
Mining properties	$1,021,510.60		
Development and organization expense	201,127.40		
		$1,222,638.00	
Less provision for exhaustion		580,000.00	
			$642,638.00
Insurance reserve fund			7,027.38
Sundry assets and prepaid expense			5,234.89
			$1,329,964.03

Liabilities

Accounts payable		$43,382.12	
Salaries and wages		8,357.16	
Accrued charges		8,518.98	
Provision for Dominion Government taxes		12,500.00	
			$72,758.26
Insurance reserve			7,027.38
Capital stock	$2,000,000.00		
Less discount on shares	667,797.00		
		$1,332,203.00	
Profit and loss (debit) balance, brought forward Dec. 1, 1921	$90,293.60		
Net profit for period, after deducting dividends paid	8,268.99		
		82,024.61	
			1,250,178.39
			$1,329,964.03

Production of bullion for the period amounted to $831,-251.05 recovered from the milling of 36,825 tons of ore. Broken ore amounts to 24,700 tons, valued at $801,568.37.

United Verde Extension Mining Co.

Copper; Jerome, Ariz.

A report of the United Verde Extension Mining Co. under date of Nov. 1 states that the output for the half year was 20,960,796 lb. of copper and for

	Pounds
July	3,579,748
August	3,553,046
September	3,209,216

The blast furnace was used only to make up production of the reverberatory, and the latter since Aug. 10 has been smelting the ore. When the reverberatory is running the saving in the cost of power over the use of the blast furnace is not an inconsiderable item.

The company is well sold up for some months, but with a steadily decreasing price.

No important developments in ore have occurred, but the 1,221 West Crosscut, which has advanced beyond the main fault, has passed through some oxydized porphyry, which gives promise of picking up the ore in the footwall of the fault.

No ore has been found in the Jerome Verde ground, although the usual footage has been done during the quarter.

The big turbine at the power plant of the smelting works at Clemenceau ran foul in August, and costly repairs were necessary, but the small turbine pulled the load in the interim. A condensed financial statement is as follows:

Cash on hand Oct. 1, 1923	$1,564,290.15
Liberty bonds, par value $3,363,950—market value	3,279,363.04
U. S. Treasury certificates	200,000.00

The board of directors, at a meeting held on Sept. 12, 1923, declared a dividend of $1 per share, payable on Nov. 1, 1923, to stockholders of record at the close of business Oct. 5, 1923.

The New Jersey Zinc Co.

A statement of The New Jersey Zinc Co. for the quarter ended Sept. 30, 1923, follows:

Income (including dividends from subsidiary companies) after deductions for expenses, taxes, maintenance and repairs, depreciation, depletion and contingencies	$1,090,793.25
Deduct interest on first-mortgage bonds	40,000.00
	$1,050,793.25
Deduct dividend 2 per cent, payable Nov. 10, 1923	979,632.00
Surplus for the quarter	$71,161.25

Imports and Exports of Metals for September, 1923 and 1922

Imports and exports of copper, lead, and zinc during September, 1923, with revised comparative figures for September, 1922, as compiled from the work sheets of the Department of Commerce, were as follows, the figures being in pounds unless otherwise stated:

Imports

	September, 1922	September, 1923
Antimony		
Ore	.....	.....
Metal, matte, and regulus	2,110,905	947,698
Copper		
Ore	7,992,820	9,436,482
Concentrates	3,758,934	5,680,052
Regulus, coarse metal and cement copper	1,064,162	633,968
Imported from		
Spain	346,595	.....
Canada	30,267	3,329,034
Mexico	316,196	3,211,996
Cuba	4,498,815	3,924,044
Chile	5,548,325	4,498,094
Colombia	8,036	.....
Peru	76,398	137,072
Venezuela	373,153	.....
Other countries	1,618,131	650,262
Unrefined black, blister and converter copper in pigs and bars	43,747,180	30,379,187
Imported from		
Spain	.....	.....
United Kingdom	11,138	11,421
Canada	11,593,789	2,574,409
Mexico	4,090,009	6,198,364
Chile	3,273,497	8,236,433
Peru	12,898,871	5,634,897
Portuguese Africa	11,113,203	6,752,654
Other countries	766,673	971,009
Refined copper	6,747,981	2,431,811
Old and clippings for remanufacture	253,675	362,721
Composition metal, copper chief value	297,537	172,000
Copper manufactures	.....	32,037
Brass		
Old and clippings for remanufacture	7,575,905	1,326,424
Manufactures of brass	.....	62,729
Lead		
Ore and matte	5,412,260	2,687,189
Bullion or base bullion	35,968,864	3,578,092
Pigs, bars, other forms and old	554,314	279,739
Manufactures of lead (except type metal)	.....	45,629
Manganese ore, long tons	(free) 46,869	(dutiable) 35,175
Pyrites, long tons	17,872	14,577
Tin		
Tin ore, long tons	1,199	178
In bars, blocks and pigs	7,378,710	9,407,968
Imported from:		
United Kingdom	392,190	2,160,559
British Straits Settlements	5,364,428	6,058,514
China	.....	.....
Dutch East Indies	500,992	469,926
Hongkong	1,121,100	584,569
Australia	.....	22,400
Other countries	.....	112,000
Tungsten ore, long tons	(free) 84	.....
Zinc ore (dutiable)	1,722,089	.....
In blocks and pigs (dutiable)	1,774	6,237
Zinc dust (dutiable)	.....	2,386
Zinc sheets	.....	3,610

Exports

In Pounds

	September, 1922	September, 1923
Copper		
Ore, concentrates, matte, and regulus (copper content)	14,023	5,053
Copper and manufactures of (total)	59,322,202	69,800,670
Refined, in ingots and bars	51,246,231	63,351,539
Exported to		
Belgium	4,765,442	7,185,278
France	11,036,902	10,926,393
Germany	15,199,231	11,110,684
Italy	4,739,656	6,632,359
Netherlands	1,225,328	1,838,632
Spain	471,356	718,047
Sweden	1,538,939	2,037,757
United Kingdom	8,646,814	13,346,219
Canada	120,685	2,990,259
China	1,792,000	3,393,600
Japan	448,000	2,574,936
Other countries	1,261,878	561,375
Old and scrap	693,502	376,693
Composition metal, copper chief value	5,386	4,837
Pipes and tubes	177,629	286,895
Plates and sheets	272,435	320,500
Wire except insulated	955,803	452,482
Lead		
Pigs and bars		
From domestic ore	51,536	267,122
From foreign ore	2,451,660	13,766,076
Exported to		
France	.....	2,576,853
Germany	896,367	1,680,576
Netherlands	224,062	1,456,189
United Kingdom	560,262	5,938,838
Other Europe	112,037	1,176,393
Argentina	.....	244,675
Brazil	347,402	797,763
Other countries	363,066	161,911
Zinc		
Dross	3,245,224	2,009,564
Spelter		
From domestic ore	2,231,792	9,944,683
From foreign ore	100,000	1,792,590
Total zinc slabs, blocks, etc.	2,331,792	11,737,273
Exported to		
Belgium	224,026	559,952
France	1,803,228	1,499,812
United Kingdom	.....	8,280,731
Canada	5,032	22,727
Japan	56,010	.....
Other countries	243,496	1,374,051
In sheets and strips	719,143	499,302
Zinc dust	342,226	850,465
Other zinc manufactures	79,916	56,837

French Metal Market Quiet

Special Foreign Correspondence

Despite the general instability now prevailing in all markets in the world, whose causes are more political than economic, the French market, although hampered by the fluctuations of exchange, is in a rather favorable position. Fairly good business has been and is being done, but only for immediate delivery, as confidence in the future is far from being firm. Consumers will not build any reserve stocks, which, later on, may be much undervalued by a sudden change in prices. Purchases of copper are now being made, in spite of the recent decline—now stopped—of the London and New York markets; of course, this decline is compensated here by the exchange value of the pound and dollar.

Copper.—More copper is now being sold in France. The French Thomson-Houston Co. has purchased the patent on automatic telephone apparatus already well known in England and in America, and which undoubtedly will be adopted in France later. Meanwhile, the company is constructing a direct cable, partly underground, from Paris to Strassburg. This will be followed by many other installations, namely those to Paris-Lille and to Paris-Lyon. However, the state is showing some hesitation in burdening the budget, as the construction of only one cable means an expenditure of several million francs. Financial establishments have planned the creation of a company which would advance the funds in capitalizing annuities that are remitted by the state.

France and other European countries are electrifying many railway lines. As a result, some electrical goods are being ordered from Switzerland. In Italy, most of the necessary supplies are purchased at home.

Lead.—The Continental market is almost entirely held by two leading French concerns—namely, Penarroya, for African and Spanish leads, and the selling agency of the former (Minerais et Metaux). The business power of this society will be fully gaged when again in competition with German trade. Before the war, the preponderance of the lead market belonged to Germany.

The actual consumption of lead in France is quite satisfactory. The French Government is now issuing a national loan for the reconstruction of the devastated regions. Contractors are again asking for credit.

Zinc.—Consumption of zinc is increasing. Galvanizing is now used to a great extent in France. Zinc enters now in the structure of a new alloy—white brass—with nickel as a basis. This alloy is easily worked and has the resistance of steel. However, its cost price is still too high for it to be of any practical use just now.

Aluminum.—French consumption of aluminum has now reached an unusual scale, so that exports had to be reduced. The use of aluminum is increasing in manufactures either as a pure metal or in the form of an alloy. In electricity, its use has given satisfactory results. New power lines are now often completely made of aluminum. French exports in the automobile trade are quite extensive. As the percentage of aluminum in the total weight of a frame is 12 per cent, the French total exports of aluminum can easily be figured out, as the number of cars shipped to foreign countries amounted for the first six months of 1923 to 12,563, against 6,406 for the corresponding period of 1922.

MINING STOCKS

Week Ended November 3, 1923

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	...	...	*58	June 23, Q	$1.50
Alaska-Br. Col.	N. Y. Curb	*70	*65	*70	...	...
Allouez	Boston	...	...	*16	Mar. '19	1.00
Anaconda	New York	35⅜	32⅝	35⅜	Se.15, Oc.22, Q	0.75
Arcadian Consol.	Boston	1⅜	1⅛	1⅜	...	...
Ariz. Com'l	Boston	8½	7⅞	8	July '23,	0.50
Calaveras	N. Y. Curb	...	...	2¼	...	...
Calumet & Arizona	Boston	...	...	46	Se. 7, Se. 24,	1.00
Cal. & Hecla (New)	Boston	19½	17	19¼	June '23, Q	10.00
Centennial	Boston	...	...	7	Dec. '18, SA	1.00
Cerro de Pasco	New York	39⅞	37⅛	39⅞	Oc.18, No.1, Q	1.00
Chile Copper	New York	26⅛	25⅛	26⅛	De.1, De.29, Q	0.62½
Chino	New York	15⅝	14⅛	15⅛	Sept. '20, Q	0.37½
Con. Cop.Min.(New)	N. Y. Curb	1 3/16	1	1⅛	...	...
Copper Range	Boston	23¼	22⅛	23⅜	May '23, Q	1.00
Crystal Copper	Boston Curb	66	63	66	...	...
Davis-Daly	Boston	2⅛	2⅛	2⅛	Mar. '20, Q	0.25
East Butte	Boston	4¼	4⅛	4⅛	Dec. '19, A	0.50
First National	Boston Curb	32	25	32	Feb. '19, SA	0.15
Franklin	Boston	1.25	*80	1.25	...	...
Gadsden Copper	Boston Curb	*40	*36	*36	...	...
Granby Consol	New York	13⅜	12⅛	13⅛	May '19, Q	1.25
Greene-Cananea	New York	14	13⅜	14	Nov. '20, Q	0.50
Hancock	Boston	1⅜	1	1⅛	...	...
Howe Sound	N. Y. Curb	2⅛	2⅛	2⅛	Oc.1, Oc.15	0.05
Inspiration Consol.	New York	26⅛	23⅛	26⅛	Se.13, Oc.1 Q	0.50
Iron Cap	Boston Curb	...	...	3⅛	May 23, K	0.15
Isle Royale	Boston	17⅛	16	17⅛	Se. 1, Se. 15,	0.50
Kennecott	New York	32⅜	29⅛	32⅞	Se. 7, Oc. 1,	0.75
Keweenaw	Boston	1	*75	*75	...	...
Lake Copper	Boston	1⅛	1⅛	1⅛	...	...
Magma Copper	New York	30	27½	29½	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	2	2	2	...	...
Mass Consolidated	Boston	1⅛	1	1 1/16	Nov. '17, Q	1.00
Miami Copper	New York	21½	20⅛	21	No. 1, No. 15, Q	0.50
Michigan	Boston	2	1⅛	1⅛	...	...
Mohawk	Boston	*32	*29	*31⅛	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	8⅛	7⅜	8⅛	Je. 8, Je. 30, Q	0.50
Nevada Consol.	New York	10⅜	9⅛	10⅛	Sept. '20, Q	0.25
New Cornelia	Boston	*16	*14½	*16	Au. 3, Au, 20, Q	0.25
New Dominion	N. Y. Curb	2⅞	2⅜	2⅞	...	...
North Butte	Boston	2	1⅞	2	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*90	*80	*89	...	...
Old Dominion	Boston	15	13⅛	14⅜	Dec. '18, Q	1.00
Osceola	Boston	...	...	31½	June '23, Q	1.00
Phelps Dodge	Open Mar.	†150	†140	....	Se. 20, Oc. 2 Q	1.00
Quincy	Boston	20	18	20	Mar. '20, Q	1.00
Ray Consolidated	New York	12⅛	10⅞	12	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	...	...	*20	...	...
St. Mary's Min. Ld.	Boston	*31	*27	*30½	Mar. '23, K	3.00
Seneca Copper	New York	5⅜	5⅛	5⅜	...	...
Shannon	Boston	*60	*42	*43	Nov. '17, Q	0.25
Shattuck Arizona	New York	5	5	5	Jan. '20, Q	0.25
South Lake	Boston	*80	*25	*85	...	...
Superior & Boston	Boston	1⅛	1⅛	1⅛	...	...
Tenn. C. & C. cfs.	New York	8⅛	8⅛	8⅛	Se. 29, Oc. 15, Q	0.25
Tuolumne	Boston	*80	*50	*75	May '13,	0.10
United Verde Ex.	N. Y. Curb	27½	27	27½	Oc. 5, No. 1, Q	1.00
Utah Consol.	Boston	1	*75	*80	Sept '18,	0.25
Utah Copper	New York	60	55⅛	58⅜	Se.14, Se.29, Q	1.00
Utah Metal & T.	Boston	*65	*41	*45	Dec. '17,	0.30
Victoria	Boston	1⅛	*70	*70	...	...
Winona	Boston	*50	*25	*25	...	...
Wolverine	Boston	6	5	6	...	...
NICKEL-COPPER						
Internat. Nickel	New York	11	10⅜	10⅞	Mar.' 19,	0.50
Internat. Nickel pfd.	New York	76	76	76	Oc.11, No.1 Q.	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	...	...	2¼	...	...
National Lead	New York	121⅓	116	121	No.22, Dec.15 Q	1.75
National Lead pfd.	New York	....	....	110⅜	Au. 24, Se.15 Q	1.75
St. Joseph Lead	New York	20	19⅛	20	Se.9, Se.20 Q, X	0.50
ZINC						
Am. Z. L. & S.	New York	8⅛	6⅛	8⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	28⅓	26	28	Nov. '20, Q	1.50
Butte C. & Z.	New York	5	4⅛	5	Mar. '23,	0.50
Butte & Superior	New York	14¼	12⅝	14¼	Je. 15, Je. 30, Q	0.50
Callahan Zn-Ld	New York	4	3⅛	4	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	139⅜	135	139	Oc.31, No.10, Q	2.00
United Zinc	N. Y. Curb	...	...	*50	...	...
Yellow Pine	Los Angeles	....	....	*70	June '23, Q	0.03
SILVER						
Alvarado	N. Y. Curb	...	...	1⅛	...	...
Batopilas Mining	New York	...	...	⅜	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*26½	*25½	*26	May '20, K	0.03
Candelaria	N. Y. Curb	*7	*4	*5	...	...
Castle-Trethewey	Toronto	*40	*36	*36½	...	...
Coniagas	Toronto	2.25	2.15	2.15	Oc.19, No.1, '23	0.02½
Crown Reserve	Toronto	*60	*59½	*59½	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	2⅝	2½	2⅝	Oc.1, Oc. 15, Q	0.12½
La Rose	Toronto	*21	*20	*20	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*12	*11½	*11½	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	3.08	2.85	2.89	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6	5⅜	5⅞	Se.3, Oc.17, Q	0.30
Ontario Silver	New York	...	...	6½	Jan. '19, Q	0.50
Temiskaming	Toronto	*33	*37½	*32¼	Jan. '20, K	0.04

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅜	⅜	⅛	...	....
Alaska Juneau	New York	1⅛	⅜	1	...	....
Boundary Red M.	N. Y. Curb	...	...	*12	...	....
Carson Hill	Boston	3½	3	3⅛	...	....
Cresson Consol. G.	N. Y. Curb	3⅛	3⅛	3⅛	Se.30, Oc.10, Q	0.10
Dome Mines	New York	36⅞	35½	36	Oc.12, No.1, Q	1.75
Golden Cycle	Colo. Springs	1.10	1.09	1.09	Dec. '22, Q	0.02
Hollinger Consol.	Toronto	11.50	11.45	11.50	Oc.18, No.25, M	0.05
Homestake Mining	New York	62	61½	61½	Oc.20, Oc.25 M	0.50
Kirkland Lake	Toronto	*35	*34	*34	...	...
Lake Shore	Toronto	3.58	3.45	3.50	No.1, No.15'23 Q	0.02
McIntyre-Porcupine	New York	17	16½	17	Au.1, Se.1, Q	0.25
Portland	Colo. Springs	*30	*30	*30	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1 3/16	1⅛	1 3/16	...	...
Tom Reed	Los Angeles	...	...	*58	Dec. '19,	0.02
United Eastern	N. Y. Curb	1 3/16	1⅛	1 3/16	Oc.8, Oc.28, Q	0.15
Vipond Cons.	Toronto	*89½	*88	*89	...	...
Wright-Hargreaves	Toronto	3.50	3.10	3.50	Se.15, Oc.1, Q	0.02½
Yukon Gold	N. Y. Curb	*75	1	*75	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	*35	*18	*24	...	....
Con. Cortez	N. Y. Curb	*49	*48	*49	...	....
Con. Virginia	San Francisco	10½	9⅜	10½	...	....
Continental Mines	N. Y. Curb	4⅜	4	4⅜	...	....
Dolores Esperanza	N. Y. Curb	...	...	*95	Jy. 1, Jy.10 Q	0.05
Jib Consol.	N. Y. Curb	...	...	*65	...	...
Tonopah Belmont	N. Y. Curb	*58	*58	*58	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	*49	*47	*49	Se.22, Oc.10	0.10
Tonopah Extension	N. Y. Curb	1⅛	1⅛	1⅛	Se. 10, Oc. 1	0.05
Tonopah Mining	N. Y. Curb	1⅜	1⅜	1⅜	Se. 30, Oc. 1	0.07½
Unity Gold	N. Y. Curb	3½	3	3½	...	...
West End Consol.	N. Y. Curb	*72	*70	*72	Mar. '23, Q	0.05
SILVER-LEAD						
Bingham Mines	Boston	15½	14½	15½	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake	*85	*85	*85	Dec. '20,	0.15
Chief Consol.	Boston Curb	3⅞	3⅜	3⅜	Au. 1, '23, Q	0.10
Columbus Rexall	Salt Lake	*31	*29½	*29½	Aug. '22,	0.03
Consol. M. & S.	Montreal	26½	25½	25⅝	Oct. '20, Q	0.62½
Erupcion	Boston Curb	2	2	2	Se. 15, Oc. 2	0.12½
Federal M. & S.	New York	9	8¾	8¾	Jan., '09,	1.50
Federal M. & S. pfd.	New York	41	40	41	Au. 25, Se. 15,	1.75
Florence Silver	Spokane	*15	*11⅛	*12	Apr. '19, Q, X	0.01½
Hecla Mining	N. Y. Curb	8⅝	8⅛	8⅛	Au.15, Se.15	0.15
Iron Blossom Con.	N. Y. Curb	...	...	*31	Oct.25, '23,	0.02½
Marsh Mines	N. Y. Curb	...	...	*11	June '21, I	0.02
Park City	Salt Lake	3.15	3.02½	3.02½	Se.15, Oc.1 Q	0.12½
Park Utah	N. Y. Curb	....	....	3	Se.15, Oc.1 Q	0.15
Prince Consol.	Salt Lake	...	...	*75	Nov. '17,	0.02
Silversmith	Spokane	*36½	*35	*35	Oc. 1, Oc. 10	0.01
Simon Silver-Lead.	N. Y. Curb	*6	*5	*6	...	....
Snowstorm Silver-L.	N. Y. Curb	...	...	*40	...	...
Tamarack-Custer	Spokane	1.40	1.39	1.40	Se.30, Oc.1, K	0.02
Tintic Standard	Salt Lake	3.25	3.25	3.25	Se. 24, Se. 29	0.15
Utah-Apex	Boston	...	...	2⅛	June '23, Q, X	0.50
IRON						
Bethlehem Steel	New York	49¾	46½	49½	De.1, Ja.2, Q	1.25
Char. Iron	Detroit	...	...	¾	...	....
Char. Iron pfd.	Detroit	...	...	1	...	....
Colorado Fuel & Iron	New York	24½	20	23½	No 10, No.26 Q	2.00
Col. Fuel & Iron pfd.	New York	...	...	102	Feb.'23, Q	2.00
Gt. North'n Iron Ore	New York	30⅜	28½	30⅜	Apr. '23	1.00
Inland Steel	N. Y. Curb	...	...	46½	No.15, De.1Q	0.62½
Mesabi Iron	N. Y. Curb	...	...	5	...	....
Replogle Steel	New York	9⅛	8	9	...	....
Republic I. & S.	New York	46	41⅜	46	May '21	1.50
Republic I. S. pfd.	New York	90	88	90	Se.15, Oc.1 Q	3.75
Sloss-Sheffield S. & I.	New York	45	42	45	Feb.'21,	1.50
Sloss-Shef. S.&I. pfd.	New York	...	...	75	Se.2, Oc.1, Q	1.75
U. S. Steel	New York	93⅜	86½	93⅜	No.29, De.29, Q	1.50
U. S. Steel pfd.	New York	119	118	118½	No.4, No.28, Q	1.75
Virginia I. C. & C.	New York	54	54	54	Je.16, Jy. 2	2.00
Virginia I.C.&C.pfd.	New York	...	...	81	Je.16, Jy. 2	2.50
VANADIUM						
Vanadium Corp.	New York	29½	27½	29½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	44	43	43	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal	70½	70	70½	Se.29, Oc.15 Q	1.50
SULPHUR						
Freeport Texas	New York	11⅛	10⅜	11⅛	Nov. '19, Q	1.00
Texas Gulf	New York	60	56½	60	Se.1, Se.15 Q	1.50
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅜	3¼	3⅜	...	....
MINING, SMELTING AND REFINING						
Amer. Metal	New York	45	43⅜	45	No.17, De.1, Q	0.75
Amer. Metal pfd.	New York	110	110	110	No.19, De.1, Q	1.75
Amer. Sm. & Ref.	New York	56	51½	56	Oc.11, No.1, Q	1.25
Amer. Sm.& Ref. pfd	New York	97	95½	96	No.9, De.1	1.75
U. S. Sm. R. & M.	New York	19½	18⅜	19	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	39	39	39	Oc.8, Oc.15, Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.

Current Prices of Mine Materials and Supplies

RISE AND FALL OF THE MARKET

Advances—Pine timbers advance $1 in New York, $2.50 in Dallas and from $2 to $4 per M. ft. in Boston. Wire nails increased 30c. per keg in Dallas. Railroad steel requirements heavy, especially in plates. Mill prices firm and unchanged for cement.

Declines—Slight decline in 60 per cent gelatin dynamite in Dallas. Manila rope lower; 1c. in New Orleans and ½c. in Atlanta. Pine timbers dropped $1 in Chicago, $2 in Birmingham, $2.50 in Detroit and Philadelphia.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$3.00	$4.45	$4.00	$5.25	$4.59
Black					
No. 28	3.85	5.20	4.85	5.80	5.15
Galvanized					
No. 28	5.00	6.35	6.85	6.50	6.15

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh			
	Current	One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	.....	$43.00
Standard openhearth rails	43.00	43.00	$43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	Current	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$3.15	$2.75@3.00	$3.00	$4.00	$5.00	$3.72
Track bolts	4.00@4.25	3.85@4.50	4.00	5.05	6.20	4.57
Standard section angle bars	2.75	2.75	2.75	4.00	4.00	3.20

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$2.50	$3.00	$3.64	$4.20	$3.45	$3.40	$3.60
Channel, 3 to 15 in.	2.50	3.00	3.64	4.20	3.45	3.40	3.60
Angles, 3 to 6 in., ¼ in. thick	2.50	3.00	3.64	4.20	3.45	3.40	3.60
Tees, 3 in. and larger	2.50	3.00	3.64	4.20	3.45	3.40	3.60
Plates	2.50	3.00	3.64	4.30	3.45	3.40	3.60

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Hercules red strand, all constructions	20%
Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%

	New York	Cleveland	Chicago
Drill Rod (from list)	55%	40@55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

	Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD	½ to 3	62	50½	⅛ to 1½	30	13
LAP WELD	2½ to 6	59	47½	2½ to 4	29	15

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
2½ to 6 in. lap welded	44%	47%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York					
	Current	One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$63.60	$55.30	$49.00	$57.20@60.20	$57.60	$61.00

Nuts—	New York	Cleveland	Chicago
Hot pressed, sq., per 100 lb. Off list	$0.50	$3.50	$2.50
Cold punched, sq., per 100 lb. Off list	.50	3.50	2.50

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York						
	Current on Trucks	One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1179	$0.1230	$0.0724	$0.135	$0.089	$0.108	.....
6x12x12	.1769	.1844	.0996	.....	.122	.156	.....
8x12x12	.2211	.2305	.1358	.23	.162	.244	$0.1968

MACHINE BOLTS—

	New York	Cleveland	Chicago
½ and 1½x3 in. up to 12 in	15 %	50—5%	50%

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to dealers in yards at San Francisco. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$40.00	$41.00	$42.00	$45.00
3x6 and 8	40.00	41.00	42.00	45.00
4x4-6 and 8	40.00	41.00	42.00	45.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5 additional.

	New York		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$49.00	$50.00	$44.50	$46.50
3x10 to 10x10	53.00	54.00	50.50	52.50
3x12 to 12x12	57.00	58.00	57.50	59.50

Other Cities	8 x 8-In. x 20 Ft. and Under			12 x 12-In. 20 Ft. and Under	
	Pine	Fir	Hemlock Spruce	Pine	Fir
Boston	$67.00	.....	$62.00 $62.00	$85.00	.....
Cincinnati	40.00	$75.00	75.00 90.00	44.00	$80.00
Denver	.....	43.25	....	.....	48.00
Minneapolis	42.00	43.75	41.50	44.00	45.75
Kansas City	.....	.....	....	.....	.....
Birmingham	30@35	.....	....	40@45	.....

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$3.00	$3.80	$4.25	$4.55	$3.34	$4.95
Cut	....	4.45	5.80	5.75	3.64	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.70@2.80	$2.70@2.80	$2.60
Chicago, f.o.b.	2.20	2.20	2.20
Cleveland, f.o.b.	2.46	2.46	2.46

LIME—Warehouse prices:

	Hydrated, per Ton		Lump, per Barrel 280-lb. net	
	Finishing	Common	Finishing	Common
New York	$18.20	$13.10	$3.75	$3.00@$3.25
San Francisco	22.00	.....	....	(180-lb net) 2.10

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrel (5 bbl. lots)	$0.98	$0.93	$1.14	$0.94

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry		In Oil	
	Current	1 Yr. Ago	Current	1 Yr. Ago
Red	14.00	12.75	15.50	14.25
White	14.00	12.75	14.00	12.75

HOSE—

	Fire	50-Ft. Lengths
Underwriters' 2½-in. coupled		51½c per ft.

	Air			
	First Grade		Second Grade	
¾-in., per ft.	3 ply	$0.33	4 ply	$0.25

	Steam—Discounts from List		
First grade	40–5%	Second grade	45%	Third grade	50%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition	60–5%	Best grade	50–10–5%

LEATHER BELTING—List price, 2c. per sq. in. per ply.

Grade	Discount from list
Medium	30–10%
Heavy	20–5–2½%

RAWHIDE LACING—For cut, best grade, 40%, 2nd grade, 50%. For laces in sides, best, 48c. per sq.ft.; 2nd, 43c. Semi-tanned: cut, 40%; sides, 48c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ¾ in.	$0.90
Rubber sheet	.45
Rubber sheet. wire insertion	.70

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.18½	New Orleans	$0.17½
New York	.18	Seattle	.18
Chicago	.18	San Francisco	.16

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin	
	40%	60%
New York	$0.27	$0.295
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.225	.25
New Orleans	.195	.22
San Francisco	.1625	.1925

FLOTATION OILS—All prices are per gal. in carload lots; 50-gal. bbls., gross weight 500 lbs.

Pine oil, steam dist., f.o.b. New York	$0.65
Pine oil, pure, dest. dist. f.o.b. New York	.60
Pine tar oil, ref. f.o.b. New York	.48
Pine tar oil, crude, tank cars f.o.b. Jacksonville, Fla	.32

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. Palmerton, Pa., per lb.	$0.09½
Litharge, delivered New York, casks, 500 lb. lots, per 100 lb.	10.40
Sodium cyanide, 220 lb. single case lots, f.o.b. New York, per lb.	.20½

NEW MACHINERY AND INVENTIONS

A Practical Blasting Cap Container

Built like the cartridge chamber of a six-shooter, the new du Pont blasting cap container is the most recent blasting accessory put out by the du Pont company. It is intended to meet a need of blasters who, for lack of a service container, have heretofore carried detonators loosely in their pockets or in the tin boxes in which they are sold. This practice has frequently resulted in serious and sometimes fatal injuries. By the use of this new device the likelihood of such accidents will be minimized.

The body of the container is made of vulcanized rubber. Drilled at regular intervals into its thick side walls are ten holes, each large enough to accommodate a blasting cap. The polished brass top cannot be removed, but can be rotated around the rivet pin which firmly secures it, so that the vent exposes the ten compartments one at a time. The container is filled with blasting caps just as a six-shooter is loaded with cartridges. After filling, the top can be turned so that the vent is effectually closed over a blind hole. Incidentally, this top is designed to prevent accidental turning, which is only one of its several safety features.

The legend—"Blasting Caps—Dangerous — Handle Carefully" — is embossed in white letters on the back of the container, along with the following safety rules:

Do not remove caps with wire or nail.

Don't tap or otherwise investigate them.

Don't carry caps loose in pocket.

Don't store in residence.

Don't smoke near caps.

Don't shoot into caps.

Attach caps to fuse with cap crimper, not with knife or teeth.

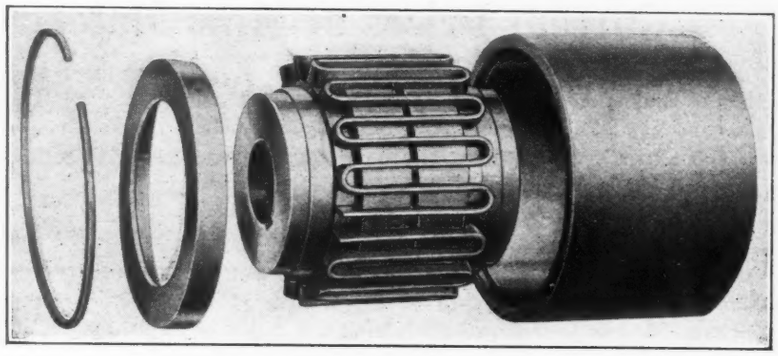
Keep in a dry place.

Keep open lights away.

Containers are made for No. 6 caps and for No. 8 caps.

A New Flexible Coupling

A flexible coupling for use on all kinds of power-transmission equipment where couplings are used has just been placed on the American market. It consists of two flanged steel disks, one keyed to each shaft, a tempered steel spring bent into the form of a continuous cylindrical grid, and a steel shell. Pitched cross grooves are cut into the peripheries of the disks into which the spring is fitted. The shell is slipped over the spring to hold it in place, to protect it from dirt and injury, and to act as a container for lubricant. When the shell is in place, end plates are fitted into it and the whole mechanism is locked together by means of clamping rings, which are sprung into grooves in the shell.



True flexibility is claimed for this coupling

Features of this coupling are the shape of the spring itself and the shape of the slots into which the spring fits. In both flanges the slots widen inward, so that each section of the spring fits closely only at the outer end of the slot. The sides of the slots are formed to circular arcs of carefully designed radius. Under light and normal loads there is a long, free span between the points of contact on the springs, but under overloads the spring sections become supported along the curved sides of the grooves. This shortens the span and results in a progressive increase of stiffness with increase of load, while at the same time the stress on the spring segments remains constant. The stress on the spring is so limited, automatically, that the coupling will safely carry unusual overloads.

The form of construction used allows both torsional and lateral elasticity. The load is distributed over a large number of spring segments, with the result that the pressure on any one segment is comparatively light. Other advantages claimed for the coupling are convenience in assembling and disassembling, freedom from wear, compactness, elimination of end thrusts, and oscillations and reduction of power losses.

The coupling, which is known as the Falk-Bibby flexible coupling, is made by the Falk Corporation of Milwaukee, Wis. It is of a type already in wide use in England.

INDUSTRIAL NOTES

The Pioneer Rubber Mills (of California) has moved its general office to its new six-story office building at 345-353 Sacramento St., San Francisco. Its mills are at Pittsburg, Calif., and the company has sales offices in the principal cities of the United States. It manufactures the "Skookum" brand of piston-rod packing, and also mechanical rubber goods, hose, and belting.

The Blacker Engineering Co., Inc., Grand Central Terminal, New York City, manufacturers of Blacker blacksmithing hammers, have opened an office in Pittsburgh at 421 Wood St., with George Hesse as district manager.

TRADE CATALOGS

Oil Burners—The Hauck Venturi low-pressure oil burner is described in an eight-page catalog issued by the Hauck Manufacturing Co., of Brooklyn, N. Y.

Couplings—Bulletin No. 33 of the Falk Corporation of Milwaukee, Wis., describes the new Falk-Bibby flexible coupling, discussed elsewhere on this page.

Steam Shovels—The Osgood Company of Marion, Ohio, has issued Bulletin 236 covering its new 1¼-yd. heavy duty steam shovel.

D. C. Motors—Bulletin No. 2014 issued by the Reliance Electric & Engineering Co., of Cleveland, Ohio, describes the company's Type T Reliance motors for direct-current circuits.

Vibrating Screens—The Deister Concentrator Co., of Fort Wayne, Ind., is now making a vibrating screen called the Leahy "No-blind" screen, which is described in a four-page folder just issued by the company.

Jaw Crushers—The Allis-Chalmers Manufacturing Co., of Milwaukee, Wis., describes its All-Steel jaw crusher in Bulletin No. 1810A, just issued. Cuts of a jaw crusher of semi-steel construction and of a double-drum automatic electric hoist for rock-crushing plants are also shown. These large crushers are intended to meet the demand for equipment to reduce the largest rocks that can be handled by the steam shovel.

Laboratory Machinery—A folder just put out by the Sturtevant Mill Co., of Boston, Mass., contains illustrations and brief descriptions of several types of laboratory crushers, a roll, a sample grinder and a swing-sledge mill.

Liquid Oxygen—M. Keith Dunham, 110 South Dearborn St., Chicago, Ill., has just issued a book entitled "Oxygen from the Air," which contains a description of the plant and process employed in producing oxygen from the air by the Oxeco liquefaction method. This catalog is handsomely illustrated and, besides a colored plate, contains numerous illustrations showing various installations.